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U. S. DEPARTMENT OF AGRICULTURE

FARMERS' BULLETIN No. 1613

PROPAGATION OF UPLAND GAME BIRDS



THE PROPAGATION of upland game birds is an industry of considerable magnitude in the United States, and there are within our borders some of the largest and most productive game farms in the world. Despite the large output already attained, the demand from State game departments and sportsmen's organizations for game birds and their eggs for restocking, from other propagators for additional breeding stock, and from fanciers and zoological gardens for exhibition specimens is so large that it is seldom necessary to dispose of birds for food purposes. Even when sale for food is necessitated (usually in the case of surplus males only), prices are good, as the demand is from the better class of restaurants, hotels, and clubs. The returns for birds used for the enhancement of sport are higher and as a rule entirely satisfactory to the producer.

This bulletin, together with Farmers' Bulletin 1612, Propagation of Aquatic Game Birds, supersedes Farmers' Bulletin 1521, Propagation of Game Birds.

PROPAGATION OF UPLAND GAME BIRDS¹

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INTRODUCTION

THE METHODS OF REARING game birds suggested in this bulletin reflect the practices of the most successful breeders. Most space is devoted to directions for the care of species that have responded best to the methods of artificial propagation. Management of species that have proved less adaptable thus far to hand rearing is outlined in a more tentative way. Success to date with the most responsive birds, however, indicates that increase of production can be carried to practically any extent desired.

GENERAL CONSIDERATIONS

LICENSES

Most of the States have laws or regulations affecting the propagation of game birds, and many require game breeders to take out licenses. The Bureau of Biological Survey, United States Department of Agriculture, Washington, D. C., supplies digests of State laws on game-bird propagation and the addresses of officials to whom application should be made for State licenses and for the full text of State laws relating to the propagation of game birds. No Federal permits are required in connection with the propagation of upland game birds.

¹ The following publications may be had free on applying to the United States Department of Agriculture, Washington, D. C.: MCATEE, W. L. PROPAGATION OF AQUATIC GAME BIRDS. U. S. Dept. Agr. Farmers' Bul. 1612; PUBLICATIONS OF INTEREST TO GAME BREEDERS. U. S. Dept. Agr. Bur. Biol. Survey Leaflet BI-203 [mimeographed]; DEALERS IN GAME AND ORNAMENTAL BIRDS. Bur. Biol. Survey Leaflet BI-458 [mimeographed].

SITE

AREA REQUIRED

Small numbers of game birds can be reared with more or less extemporized equipment moved about within the confines of a roomy dooryard or in a small orchard. Game-bird propagation on a sustaining and business basis, however, requires plenty of room. For reasons to be explained under the heading "Crop rotation," the area of land available should not be less than four times that required to care for the birds properly for a single year. Plenty of space is needed for the further reason that in most cases it is desirable to produce birds that will be as wild and wary as possible. These qualities improve the chances of planted birds escaping natural enemies and can be achieved to the maximum only on grounds where the birds can roam with the least restraint.

SOIL FERTILITY

To be successful, the propagation of game birds must be on a crop basis. On the efficient and economical game farm as much as possible of the seeds, grain, and forage consumed by the birds must be produced on the ground. Insects, so necessary an element in the food of the young, must be wholly of local origin. This vital food supply, a substitute for which is so difficult to find, and which in most cases more than any other factor decides the success or failure of game-bird production, depends almost directly upon soil fertility, for insects can subsist in abundance only upon rank vegetation.

No land is too good for a game farm. Those who hope to succeed on tracts useless for other purposes, on barren areas where almost every particle of food consumed by the birds must be brought in and hand fed, will rear their birds only at much greater cost of efforts and funds, and probably will suffer many disappointments. In such places the vitalizing elements are lacking, and it will be difficult if not impossible to produce there the healthy, vigorous stock necessary for continuous maintenance of a game farm.

CROP ROTATION

Soil fertility is not only an initial requirement for the successful game farm; it must also be maintained. In fact, the purely agricultural phases of the game farm must be managed with just as much foresight and care, and in much the same way, as a hay or grain farm that is kept on a profit-yielding basis. Proper cultivation of the soil is important, not only in preserving the basis of production but also in rejuvenating the land after the fouling that is unavoidable when large numbers of birds have been kept on it for some time.

Plowing, fallowing, fertilizing, planting, and cultivating are as essential to the upkeep of the farm upon which game birds are the crop as on any other. To rest and renovate fields upon which a crop of birds has been reared it is advisable to follow with little change the scheme of crop rotation that has been found satisfactory in the region concerned.² The special object of crop rotation on the

² Information on crop rotation and publications on the care of the crops recommended may be had from the Bureau of Plant Industry, United States Department of Agriculture.

game farm is to end it with a mixed growth of hay-producing plants as lush, luxuriant, and healthy as it is possible to produce. In such an environment breeding stock can be kept vigorous and productive, and young birds can be reared quickly and with the smallest losses. Cultivate as smoothly as possible so as to give many nearly level spots on which coops can later be placed.

As a sample of rotation methods, those in use on the New York State game farm, at Sherburne, may be cited. In the short or 2-year rotation the land is broken, cultivated, and planted to corn immediately after its use, either as a breeding or rearing field, in the spring. When the corn is taken off in the fall a mixture of timothy, clover, and redtop seed is sown, and the field is used for birds again the next year. In the long rotation oats or wheat follow the corn, extending the round one year.

WATER SUPPLY

A copious supply of good water is a necessity for the game farm, and assurance of its existence and dependability should be obtained before proceeding further. In arid regions especially success is dependent upon water. Even in such areas, however, with a plentiful source of good water and a sprinkling system installed in the propagating inclosures, conditions of more humid districts may be satisfactorily imitated, including the growing of cover crops.

SANITATION

Birds are unable to tell of their discomfort, and often no difference in appearance or behavior can be noted before one is sick unto death. Treatment then is generally ineffectual. From every point of view the watchword should be "prevention." One cardinal rule for the game farm is to keep the living quarters of the indispensable poultry always entirely separated from those of the game birds. Domestic fowls have diseases to which they are more or less resistant but which may carry off captive game birds like a plague. It is well even for the sake of the poultry to change their quarters occasionally and to renovate the land; but under no circumstances should ground fouled by poultry be used for game birds until it has been baked by the summer sun, frozen by the winter cold, and plowed, fallowed, planted, and renovated to the last degree of thoroughness.

The prevention of disease depends to a great extent also on the policy followed in respect to the introduction of new stock on the game farm. On a going farm it pays to let well enough alone. The acquisition of fresh stock is fraught with such danger that it should not be undertaken except when the need is unmistakable. The fertile, well-managed game farm will have vigorous healthy stock, and once having it, a reasonable degree of selection being exercised, the owner need give no consideration to the fear of inbreeding. When for some important reason it has been decided to bring in new birds, they should be held for observation for some time before they are allowed to mix with the regular stock. For this quarantining, roomy and sanitary inclosures should be provided, since crowded quarters in themselves tend to promote disease.

CONTROL OF ENEMIES

After disease, feathered and furred flesh eaters, popularly called "vermin," are the worst obstacles to success that the game farmer has to overcome. Among birds, Cooper's hawk is probably the worst pest on upland-game-bird farms, with the sharp-shinned hawk, great horned owl, and crow scarcely less important. Sometimes other hawks, as the red-tailed and the red-shouldered, are tempted by the plentiful supply of food offered by a well-stocked game farm; but, as these hawks are habitual mousers, warfare against them should be upon individuals proved to be rogues and not upon the race. Even the ordinarily beneficial little sparrow hawk at times can not resist an easy chance to pick up young pheasants. Owls other than the great horned owl are occasional marauders, and even crow blackbirds (grackles), red-headed woodpeckers, and blue jays sometimes become destructive to pheasant chicks.

Among mammals the most dangerous enemies of birds on game farms are cats, free-roving dogs, rats, and weasels; of less importance are minks, foxes, badgers, skunks, opossums, and raccoons. Even the little ground squirrels or picket-pins of the prairie States eat the very small young of game birds. Snakes sometimes figure prominently as egg thieves.

These various animal pests find a center of attraction in game farms, and the necessity for their control in such places is freely admitted. Efforts along this line, however, are apt to vary widely. Some are well considered, selective, just, and sensible; others are blundering, indiscriminate, unnecessarily cruel, and fanatical.

FENCING

Usually the main dependence for predator control is appropriate fencing. The entire farm may be surrounded by a permanent vermin-proof fence; or the rearing or breeding fields may be guarded either by semipermanent fences, or even by temporary and easily movable fences that will exclude most natural enemies; or all such fencing may be dispensed with and only the bird pens themselves used to give protection. The pens are usually built so as to keep out both ground and winged enemies.

PERMANENT FENCE

Fencing of a type deserving to be called permanent is expensive—prohibitively so in most cases where profits are an object. Suggestions, however, as to the construction of such a fence may be in some demand, and hence are given here. The permanent fence should have concrete posts and foundation of equal thickness, the latter extending about a foot both above and below the ground, and into the upper part of it the woven wire should be embedded. All mesh should be of the type galvanized after weaving. The lower course of 30 to 36 inches should be of $\frac{1}{2}$ -inch or $\frac{3}{4}$ -inch mesh and should have extending outward from its upper margin an overhang 1 foot wide of the same mesh. The upper part of the fence should be of not more than 2-inch mesh, and the top of it supported by a tightly strung barbed wire. Several other closely spaced strands of barbed wire or another overhang should form the top of the fence. The total height, excluding overhang, should be at least 8 feet. Modifications

that may be made in this fence that will not seriously affect its permanency are the use of creosoted poles for all but corner and gate posts, and creosoted cypress (pecky for economy) planks 1 by 6 inches, instead of the concrete base.

SEMI-PERMANENT FENCE

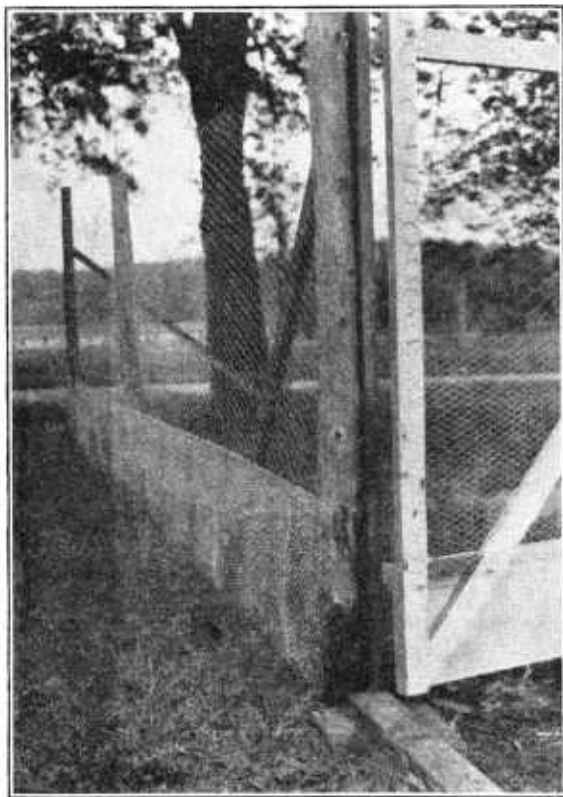
The ordinary semipermanent fence (fig. 1),³ generally used where the degree of protection it affords is sufficient, departs from the ideal in several respects. However, wire galvanized after weaving is preferably used. The posts are all wood, creosoted at the base if possible; the mesh of the lower course is 1 inch, and about 6 inches of this strip is buried in the ground. The overhang if placed at the top of this width is of the same mesh, for it is wasteful to use for an overhang mesh smaller than that which it surmounts, because small climbing predators will go through the first openings they find large enough.

The upper course of the ordinary fence is of the familiar poultry netting (2-inch mesh), and the overhang (1 to 3 feet wide) at the top is of the same material.

The height should be 8 feet but sometimes is only 7. It is well to have a supporting strand of barbed wire along the top to keep the fence in better shape and especially to resist the weight put on the netting by sleet storms. It may be necessary also to reinforce a netting fence with barbed wire strung where horses, cattle, or hogs may come in contact with it.

TEMPORARY FENCE

Where the vermin problem is not serious or where general activity against predators keeps them under such control as not to involve too



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FIGURE 1.—Semipermanent vermin-repelling fence

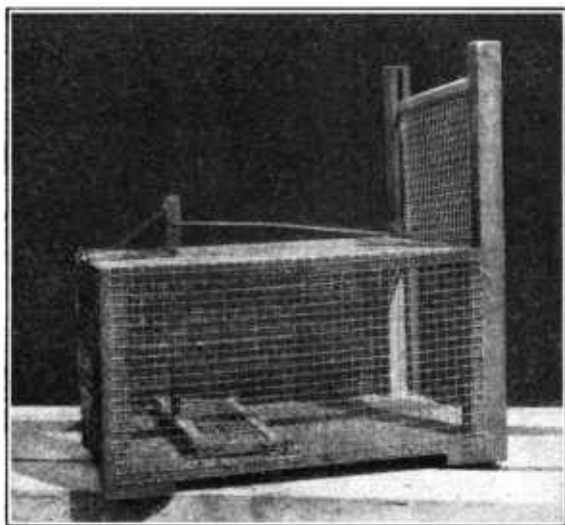
³ Of the illustrations in this bulletin, Figure 14 was contributed by the Conservation Commission of New York, the cover cut and Figure 23 by J. Carlton Hunting, Figure 26 by the late Samuel C. Evans, and Figure 27 by D. H. Beyea.

great risks, temporary or portable fencing is used to advantage. The supports for such fences are light poles put in holes made with a crowbar. The lower course (3 feet) of the fence is of 1-inch mesh (sometimes closer when it can be afforded) that has a single furrow turned over its base. The upper part (6 feet) is poultry wire without overhang. The two strips of mesh are pinned together with nails. This fence can be quickly and easily moved from one field to another, and on account of the frequent rolling and general wear

and tear that it undergoes, for economy it is usually made of wire galvanized before weaving.

TRAPPING⁴

Theoretically, a vermin-proof fence should make trapping unnecessary. Unfortunately such fences rarely are entirely proof against natural enemies, and, if so at first, seldom retain perfect effectiveness. Predators having once entered the game farm or subsidiary inclosure, it is necessary to combat them directly, and trapping is a favorite method. Traps are indispensable aids in controlling vermin, but their use is often



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FIGURE 2.—Evans vermin trap. This trap is 14 inches high, 17 inches wide, and 24 inches long. The front standards are 27 inches tall and contain a slot three-eighths of an inch wide and five-eighths of an inch deep. The door measures 15 by 12 inches. Door and treadle (6 inches wide) have the edges soldered in folded strips of heavy zinc. Mesh is five-eighths of an inch square heavily galvanized. All screws are brass, the spring phosphor-bronze, and the levers iron. The corner posts are tinned inside and the whole trap dipped in paint. The small triangle of tin on the far standard falls across the slot when the door is down and prevents it from being raised

turned to abuse. Care should be taken as to where and when they are set, and as to how long they remain set. A set trap is dangerous 24 hours a day every day, and will catch other creatures just as effectively as those particularly sought. It should not be placed, therefore, where it will be a menace to other than the offending animals. It should not remain set after danger has passed. While set, it should be inspected at least once daily so as to shorten the period of the captive's sufferings, and to release an innocent creature alive. This last consideration makes traps that catch their victims alive and uninjured preferable to traps that kill or that cripple when they do not kill. A decided advantage of such traps is that stray game birds getting into them can be restored to stock.

⁴ The limits of this bulletin prevent giving specific instructions for trapping various kinds of animals. These may be found in general works on the subject of trapping, a list of which may be had upon application to the Bureau of Biological Survey, U. S. Department of Agriculture. State laws relating to the protection of fur-bearing animals, many of which are on the game breeders' list of vermin, are digested in a farmers' bulletin that can be obtained from the U. S. Department of Agriculture.

TRAPS FOR GROUND ENEMIES

The Evans vermin trap illustrated in Figures 2 to 4 is ideal for ground enemies, since it can be built in any desired size and captures without injuring. Probably the best way of disposing of destructive animals caught in this trap is to shoot them with a small-caliber pistol, which can be carried in a pocket without inconvenience. Harmless snakes, toads, frogs, rabbits, and other innocuous animals caught in this trap can be released alive if inspections are made daily, as they should be.

The Evans trap is very effective when set with the side close against a fence. (Fig. 4.) Sometimes a stake is placed against the outer frame of the door to hold the trap firmly against the fence and to support a short wing of wire netting flaring off to another stake to direct into the trap animals that might otherwise pass a few feet away. Sometimes the trap is set with the mouth against an opening in the fence, and so hooded over with wire netting that entrance into the trap is the only possible course. Ordinarily no bait is required, but should its use become desirable, it can be wired to the back wall of the trap.

Other traps capturing animals alive are illustrated in Figures 5 and 6. The Melbrook trap is framed with channel iron, covered

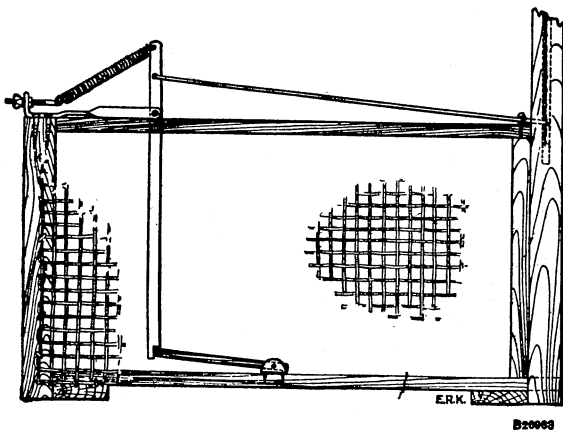


FIGURE 3.—Operating parts of Evans trap

with wire mesh, and provided with a door and treadle of heavy-gauge sheet iron; its strong construction, all of metal, is an advantage in preventing gnawing animals from getting out and in making the trap easy to clean. The Fooks trap (fig. 6), seen in Europe, is especially useful for setting along fences or in comparatively small spaces likely to be the runways of predators and is said to be most effective when covered with brush. It is a tunnel-like box about 40 inches long and 8 inches square and is always open at both ends and set except when it contains a captive. It contains two treadles, each approximately half as long as the box, which are covered with sheet metal to prevent rats from gnawing out. The remainder of the inner surface also can be lined with sheet metal or wire mesh if it is found to be necessary. The treadles are thin at the outer end and fit snugly against the floor in the set position. They pivot at about the middle, and an animal passing this point tips them up at the outer end, which remains raised because of a wire wicket slung underneath, which catches on the floor and prevents the outer end of the treadle from coming down and which in the fully vertical

position holds the treadle firmly up against the top of the entrance. The treadle occupying the other half of the trap operates instantly as the captive passes the middle. A door on top at the middle gives opportunity for inspection through the netting roof or lining.

In certain cases it is necessary to vary the method of trapping, and then ordinary steel traps can be used. These are probably the best devices for use against rats⁵ under buildings and other structures. Great care must be taken, however, to set these traps where game birds can not get into them. In burrows under objects and in holes where the birds can not go the trap may be set without special protection. Elsewhere it may be put under a box with a notch cut in the edge, under a troughlike shelter made of three boards, or under a cover improvised from wire netting; in each case, however, the entrance to the trap should be so small that the birds can not get in.



FIGURE 4.—Evans trap set along fence

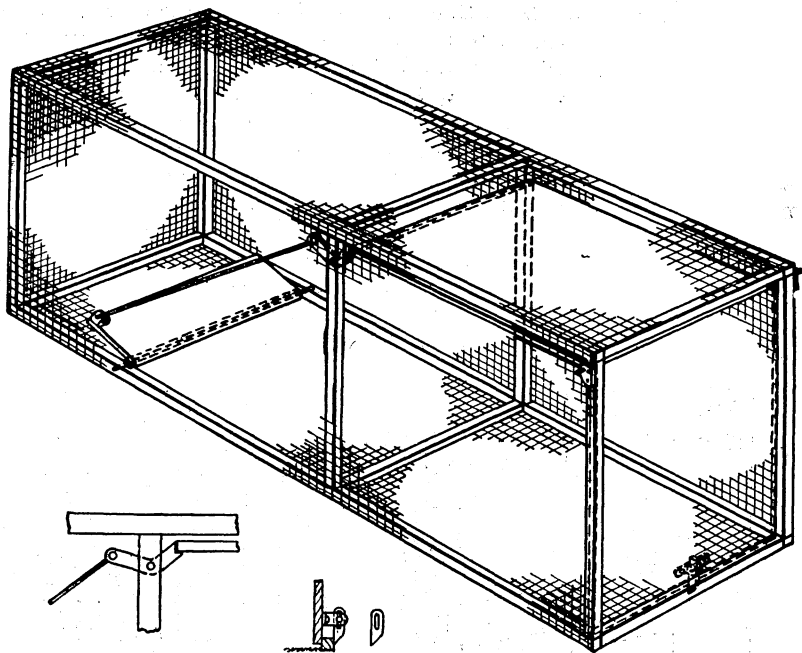
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All such sets are best made along fences where ground enemies are prone to run. Ground traps of all kinds should be kept out of rearing fields where there are small game birds.

TRAPS FOR BIRDS OF PREY

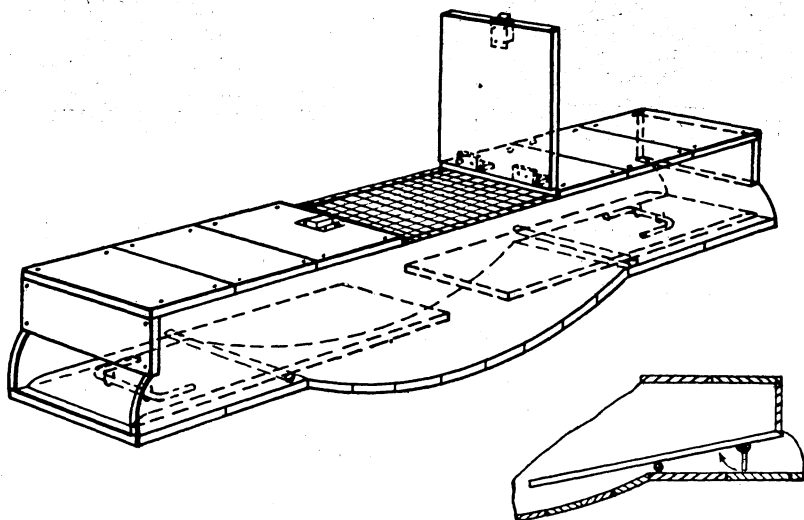
Winged enemies also have been combated chiefly by use of traps. The most common device is an ordinary steel or jump trap set on the flat top of a post or pole and fastened to it by the chain of the trap. These traps instantly kill small birds getting into them and usually are the cause of lingering death to larger species, which in their struggles fall with the trap from the top of the pole and hang head down until death ensues. Birds that do retain their perch on the top of the pole usually have one or both legs injured so that it is

⁵ Full information on the control of rats is contained in the following publication: SILVER, J. RAT CONTROL. U. S. Dept. Agr. Farmers' Bul. 1533, 21 p., illus. 1927.



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FIGURE 5.—Melbrook trap in set position; the door (under near half of top) falls when the treadle is depressed, releasing the trigger shown in separate outline drawing, and has a sliding bolt that catches on frame and holds the door closed



B4134M

FIGURE 6.—Fooks trap. The middle section of the bottom need not be round but can be broadly V-shaped

necessary to kill them. These troubles can be obviated in part by having the chain of the trap attached to a large ring around the pole, or a smaller one on a wire, that will slide to the ground when the trap is moved from the top. This permits the release alive of any useful bird that has not been crippled by the first grip of the trap.

As ordinarily used, pole traps are objectionable in several respects. Not only should the number be reduced to the minimum, but also the objectionable features of those kept in use should be lessened. Breaking the legs of larger birds can be prevented by wrapping the jaws

of the trap near the ends with hard cord of sufficient diameter to keep the jaws well separated when sprung. This will hold the larger birds but will permit the escape of such smaller ones as are not disabled or killed when struck by the jaws of the trap.

The indiscriminate killing of various small birds is the greatest fault of pole traps. If the traps are set at all times, a number of small birds will be killed to every hawk captured. It is a painful experience to make the rounds of a game farm and find flickers, red-headed woodpeckers, kingbirds, and bluebirds dead in the pole traps. Such destruction of innocent birds not only constitutes unnecessary cruelty but is also

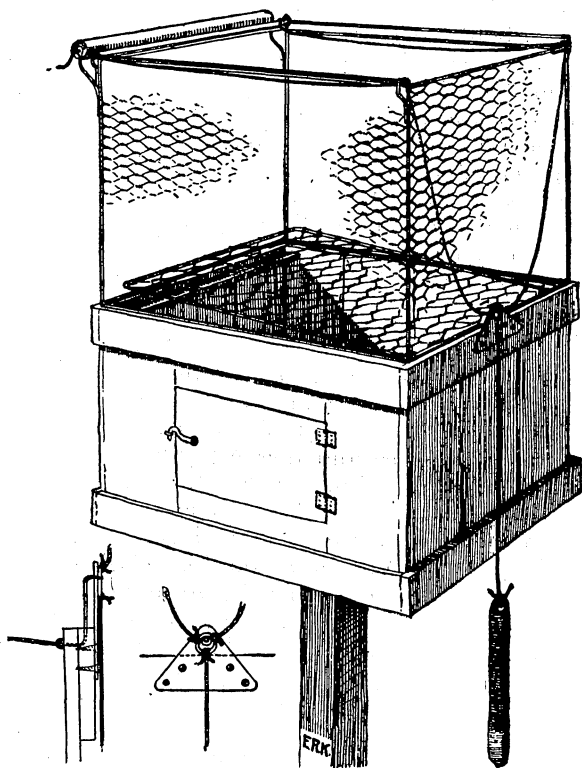


FIGURE 7.—Basket trap for hawks. A live chicken or pigeon is kept in the lower part of the trap for bait. A hawk endeavoring to strike the fowl depresses the wire-netting floor of the upper part of the trap, releasing the weight, which pulls over the top of the trap the rolled curtain shown at the left

wasteful of these useful bird lives and in most cases is a violation of Federal or State law. The killing of small birds by pole traps can be obviated, in part, by setting traps too heavy for such birds to spring them. Another device is to put a pad of cotton under the pan that will compress under the weight of a larger but not under that of a smaller bird. Both legal and humanitarian considerations require that the use of pole traps be carefully regulated. If moderation in using them is not observed, legislation entirely forbidding their use may be expected.⁶

⁶ They are now outlawed in New Jersey.

Devices that make it possible greatly to reduce the number of pole traps and at the same time to retain the effectiveness of those used against predatory birds are (1) tapering the tops of most of the fence posts to a point, and (2) guarding flat-topped posts by inserting in each an erect, slender wire to prevent large birds from perching upon them. If all the ordinary fence posts are so treated and only selected posts or poles provided with traps, the large birds will be driven to the latter when they seek to alight. Some hawks habitually perch to watch for prey, and while these are the species least destructive to birds, they are the very ones that are most frequently caught in pole traps. The bold, dashing bird hawks are more apt to come skimming over the tops of fences and pounce without a pause upon the first victim that offers.

Because of their selective destruction of the less harmful hawks, and of their danger to bird life in general, pole traps should be abolished as rapidly as practicable. Traps that capture birds alive should be substituted for them, so that harmless species can be released. Suggestions for such a trap are given in Figure 7. A cage with live hawks or owls in it attracts other birds of these kinds, and may be placed near a pole or basket trap to decoy such visitors to the farm.

SHOOTING AND OTHER METHODS

Patrolling the game farm by an armed man with a well-trained dog is probably as satisfactory a method for the control of diurnal enemies as can be had. This conclusion rests on the supposition, however, that the man knows his business and does not blaze away at everything alive on the place except the game birds. The man can be and should be selective in his war on predators. His presence, together with an occasional shot from his gun, should have a strongly deterrent effect on the visits of winged enemies, and his watchfulness and activity should strictly limit depredations by ground vermin. More crows and hawks can be killed by using an owl decoy and by shooting from a blind or cover than by other methods. Crows also can be poisoned with eggs treated with strychnine, but these should be placed so that valuable animals can not get them.

Where patrolling is carried on, scarecrows (fig. 8) may have some value. When manlike figures are always stationary, birds become accustomed to them, but when there is also some patrol work, with moving about and shooting, the warning effect of the stationary figures is much greater.

The Clove Valley (N. Y.) Rod and Gun Club has found that it pays to keep a good stock of cottontail rabbits as a first line of defense against enemies on areas stocked with game birds. Foxes, weasels, and certain other predators seem to prefer the rabbits or find them easier to catch; accordingly rabbits are imported into the preserve every year.

SHIPPING UPLAND GAME BIRDS

Troubles in shipping game birds, varying from minor mishaps to disasters, some of which might not even be imagined by the novice, have been encountered from time to time, and for the most part are guarded against by experienced breeders and dealers. Not only are

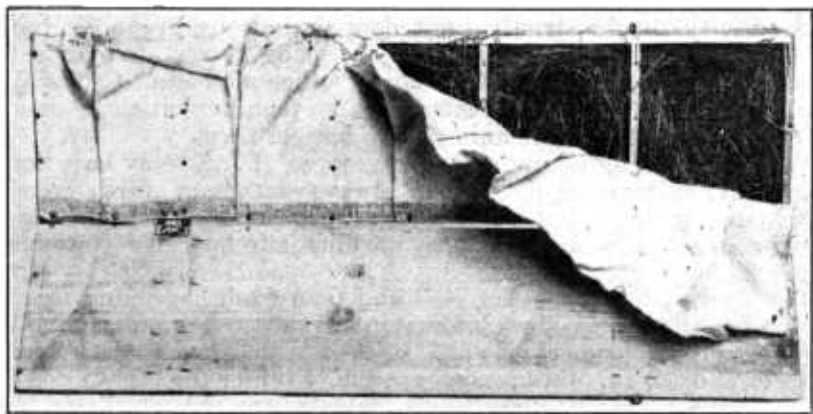
losses of valuable birds likely to result from improper shipping methods, but the usefulness of birds as breeders, at least for the first season and sometimes longer, may be destroyed by terrifying experiences in transit.



B26973

FIGURE 8.—Scarecrow in rearing field. The inner support is a crosslike frame. An outer stake is inserted in head. Bright sheets of tin, so arranged as to turn with every breeze, are suspended from ends of arms

For shipping a few birds a short distance, nothing surpasses a roomy basket of the climax type. Such a container is light, and the prominent upstanding handle reduces the chances of its being thrown about and also prevents piling other objects on top of it. The basket can have holes to admit air and light, but these should be so small that the birds can not possibly stick their heads through. The top should be close-fitting and firmly fastened. These baskets



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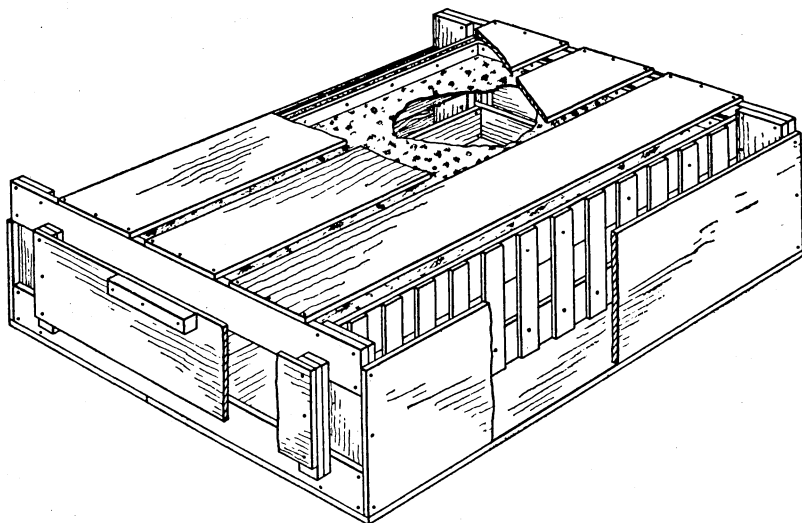
FIGURE 9.—Shipping box for day-old chicks. Dimensions: 28 by 7 by 4½ inches. The flannelette is tacked down and screw eyes are wired together before shipment

can be had in various sizes, from which selection can be made according to the size and number of birds to be shipped.

Young birds are commonly shipped in the basket type of container, but on some game farms that feature the distribution of

day-old chicks special shipping boxes (fig. 9) are provided. These are long, flat boxes containing a series of compartments, in each of which 10 baby pheasants are snugly packed in a thick nest of soft hay and covered with flannelette, which is tacked down all around the edges and to the partitions between compartments so that the youngsters can not get out. These containers are shipped any distance that can be covered by ordinary or air mail in 48 hours, and are accompanied by directions for turning them over to broody hens immediately upon receipt and for feeding them. Broody hens and food also are shipped along with the young to customers desiring this service.

A type of container convenient for ordinary shipments of upland game birds is illustrated in Figure 10. This approximates the



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FIGURE 10.—Light shipping crate for upland game birds. Spaces between boards and special ventilators at ends provide for ample circulation of air. Front food trough accessible through stanchions is for grain or mash; back one, reached through longitudinal slot (seen through opening represented in top fender), is for lettuce and the like and for a water container if one is provided

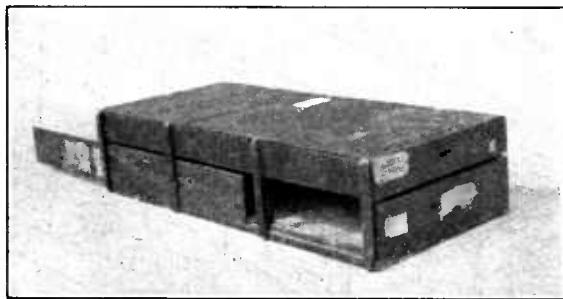
regulation crate used for importations of Mexican quail, the specifications for which are as follows:

Each crate shall have a false top of stout cloth or burlap stretched taut and smooth, so as to leave a space not less than $1\frac{1}{2}$ inches between the cloth and the top of the box, and shall be provided with a handle at each end. Crates must measure inside not less than 6 inches in height (from floor to false top) and have approximately 20 square inches of floor space for each bird. Not more than 24 quail shall be placed in a single small crate or compartment, and not more than 48 in a double crate with a partition separating the two compartments. The feeding compartment must project 3 inches or more to prevent crates from being stacked close together, thus cutting off ventilation. Quarter-inch intervals must be left between the boards forming main body and half-inch intervals between the slats forming the top of the crate to provide ventilation.⁷

⁷ UNITED STATES DEPARTMENT OF AGRICULTURE, BUREAU OF BIOLOGICAL SURVEY. REGULATIONS FOR THE ISSUANCE OF PERMITS FOR BOBWHITE QUAIL IMPORTED INTO THE UNITED STATES FROM MEXICO. U. S. Dept. Agr., Bur. Biol. Survey Service and Regulatory Announcement 69, 2 p. 1927.

The essentials of such crates are light construction, projecting food hoppers, the false top or fender, and ample ventilation. Dimensions can be varied to suit the kind and number of birds shipped, but it is well to remember that overcrowding should be avoided; best results are obtained with only a moderate number of birds to each container. Somewhat stancher construction may be obtained by substituting for the end-ventilating device a board that will be flush with the remainder of the wall. This may be prepared as a sliding section by adding upright cleats across the end boards at each side, thus making a convenient place for putting birds into the crate and taking them out. It should be fastened with screws.

A crate suitable for shipping a considerable number of birds a moderate distance when it is desired to send them in one lot, as for exhibition purposes, is illustrated in Figure 11. This crate is 5 feet long, 27 inches wide, and 14 inches high. The ventilating crack extending all around is seven-eighths of an inch wide. The sliding panel in front, when closed, is screwed into position to prevent tampering with the birds.



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FIGURE 11.—Crate for shipping upland game birds

In the case of birds caught wild for introduction into another continent, the care of freshly captured specimens is of importance. Handle them as gently as possible at all times, especially avoiding compression of the body, pulling of feathers, or holding the birds by the legs, which may be broken by a sudden effort to escape. As soon as practicable place them in a darkened room or case, with only a little opening near the floor to give light near which the food should be placed. If only a room or other spacious inclosure is available, the quill feathers of one wing should be cut off to prevent the birds from dashing against the walls, or brails may be applied. (See p. 20.) A low perch may be provided for tree-frequenting species. When the birds are ready to ship, preferably after they have become somewhat accustomed to confinement, place each individual of large or mixed species in a separate crate or compartment. Several partridges and similar small species can be put together. A single door at the back will serve for putting the birds in, and it may be nailed shut for safety during shipment.

Whatever sort of shipping container is adopted or improvised, a few general principles should be observed. The container should be so built that it will have a definite and easily recognized top side, or even so that it can not possibly be set on that side, in order to minimize the risk of overturning. Also the top should be distinctly marked "Handle with care," "Do not delay," "Live birds; rush," "Keep in a cool dry place," or with similar conspicuous signs giving essential directions. Light should be admitted to the container, but there should be no holes through which the birds can put their heads

and no openings about the lower sides or bottom through which their feet might slip. The inside should be high enough to permit the birds to stand fully erect. Slatted coops or boxes with wide cracks can be lined with cheesecloth, and wire netting should never be used without cloth guarding to prevent the birds from injuring their heads. All nails should be well clinched. A good layer of shavings, leaves, straw, or other absorbent material should be provided on the bottom, and on long trips changed every few days. The top of the container should be provided with a fender of tightly stretched fabric an inch or more beneath the wood, or it should be padded with excelsior, straw, or the like under cheesecloth or burlap.

Unless it is unavoidable, expressmen and others should not be depended upon for feeding and watering the birds, for they may fail to do it or may give them something that will be injurious. For a 24-hour trip food and water can be dispensed with, but for trips of moderate length food hoppers should be fastened firmly to the inside of the cage and charged with enough of the birds' ordinary rations and grit for the trip. A leading reason for the commonly successful shipment of quail and partridges is that it is easy to supply small grain and mixed seeds, which are a good substitute for their natural food. Birds more exacting in their requirements, or more delicate or valuable birds, should have special foods both animal and vegetable, approaching their natural preference as closely as may be. Bulky foods of less nutritive value always are preferred to concentrated ones. Hence if dried wild fruits can be obtained, they will form a valuable variant of the diet; possibly raisins or pine nuts can be sparingly substituted. Green foods are always desirable for their own sake and as a substitute for water; heads of lettuce or halves of apples, beets, turnips, carrots, or the like, which are useful in the same way, may be fastened to the ceiling where they will remain clean.

In the case of birds shipped without a caretaker, advance notice of shipment and probable date of arrival should be given. Large lots of birds on an extended trip, or other especially valuable shipments, should have a caretaker traveling with them. Cages may be cleaned and exceptionally wild birds fed and watered through a low opening across the bottom of one of the walls. For more tractable birds it is convenient to have a feeding and watering tray projecting from the floor of one side of the container, access to which by the birds is through a narrow longitudinal slot or through openings between closely placed vertical pegs. Food should be varied, clean, frequently replenished, and remnants thoroughly cleaned up. Grit should not be forgotten. It is well to add a little disinfectant to water, such as a few drops of some saponified cresol solution, or one part of corrosive sublimate (mercuric chloride) to 4,000 parts of water. Avoid ice water. The water receptacle should be kept scrupulously clean. On board ship, when the weather is not cold, crates containing birds can advantageously be kept on deck, well sheltered from the wind, with canvas overhead to screen off direct sun or rain. In cold or unfavorable weather they must be taken below. Different species of birds or different sizes of young should not be mixed in the same crate, as the larger birds will fight and injure the smaller.

SHIPPING EGGS

Standard containers (fig. 12) for pheasant eggs are now available, and made-to-order shipping crates for eggs of other game birds no doubt can be had. These crates have molded paper forms closely fitting the eggs; for shipment in other types of containers, eggs should have individual wrappings. Some shippers wrap the eggs in two long strips of newspaper, one applied at right angles to the

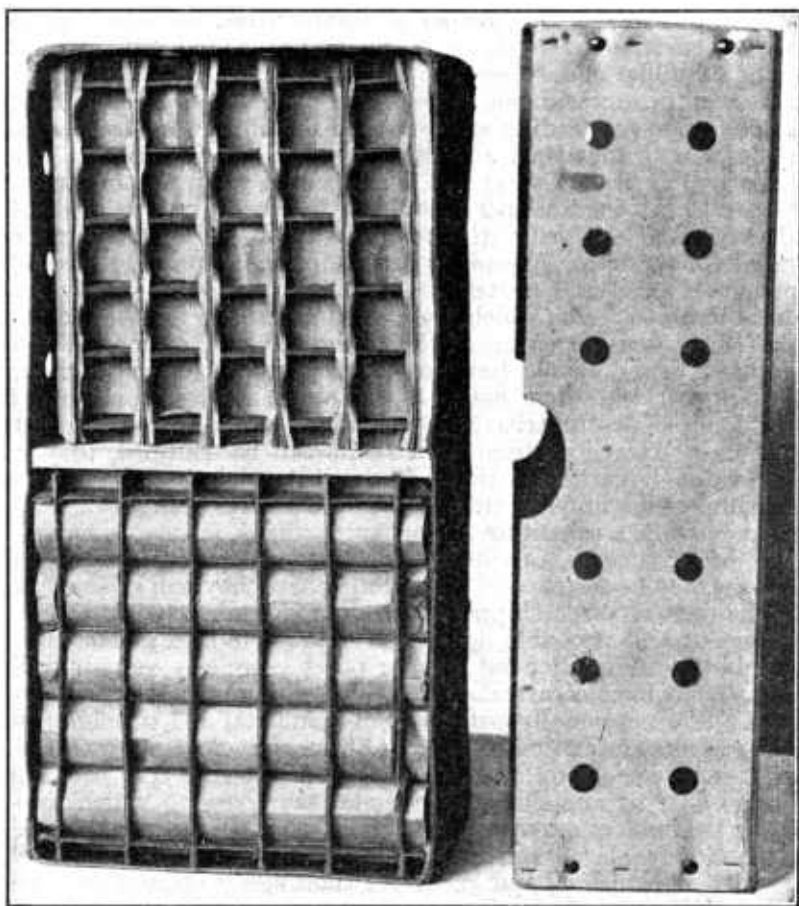


FIGURE 12.—Standard container for shipping pheasant eggs

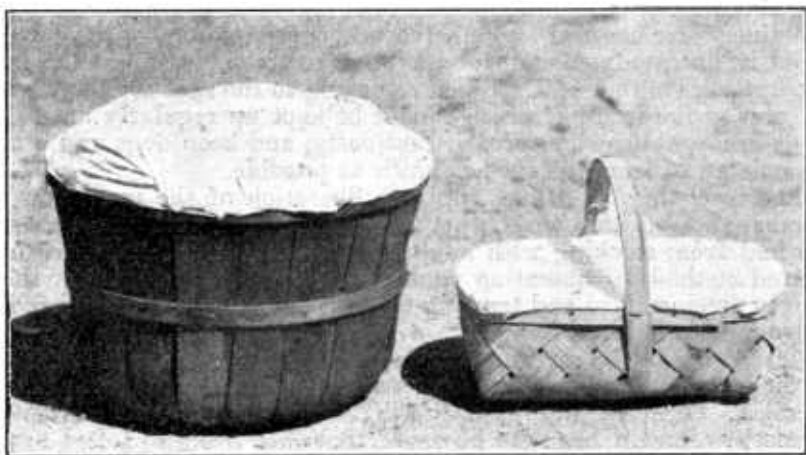
other; others twist them up tightly in wisps of hay. The outer packing for these individual eggs may be shavings, excelsior, hay, or similar shock-absorbing material. The best containers are baskets of the oblong grape-basket type or the round peach-basket type. (Fig. 13.) Both are light and suggest careful handling, and neither can be stacked with heavier objects.

IMPROVING COVERTS FOR UPLAND GAME BIRDS

The favorite resorts of upland game fowl have long been known as coverts, no doubt on account of their being admirably adapted to

cover or conceal the birds. Such coverts are usually characterized by an abundance of low but dense and stiff or thorny shrubbery, together with luxuriant growths of grasses and weeds. These plants supply also an important part of the food of the birds.

Bobwhites frequently use coverts of plum, rose, alder, bayberry, sumac, and blackberry bushes, and dense banks of honeysuckle. These plants furnish food for the birds, but they should be supplemented by others more exclusively adapted for the purpose. The quail is especially fond of mulberries in addition to those previously mentioned. Among valuable seed-bearing plants are Japanese clover, beggar lice, buckwheat, sorghum, broomcorn, kafir corn, millet, wheat, vetches, cowpeas, and any plants of the pea family producing small seeds. These are sown in large quantities in cultivated areas known as feed patches. The seeds of milk pea (*Galactia*), partridge pea (*Chamaecrista*), hog peanut (*Falcata*), wild bean (*Strophostyles*), and smartweeds (*Polygonum*) are important natural



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FIGURE 13.—Baskets of pheasant eggs as packed for shipment

foods of the eastern quail, but their growth should be encouraged only where they will not become weed pests. Western quail are fond of the seeds of sumac, bur clover, alfilaria, lupines, napa thistle, and turkey mullein, but where these plants are likely to become nuisances the food species recommended for the eastern quail will serve. Some quite valuable kinds will volunteer in newly plowed land, so that merely turning the soil improves the area as a feeding place for quail. The Hungarian partridge, like the bobwhite, thrives in open country, where often the chief cover is furnished by growing crops, hedges, or brushy fence rows. Improved coverts for the bird may be made, however, by planting much as recommended for quail.

Coverts for grouse, as the sharp-tailed, should abound in such plants as rose, sumac, blueberry, bearberry, buffaloberry, snowberry, dwarf birch, and alder. The ruffed grouse thrives among scrub oak, bayberry, rose, sumac, dwarf birch, alder, poplar, willow, and such fruit-bearing plants as partridgeberry, hawthorn, shrubby dogwoods, viburnum, wild grape, mountain-ash, blueberry, blackberry,

and cranberry. Cover of this nature is suited to pheasants also, but it is well to supplement the food supply furnished by these shrubs and trees by planting small grains and legumes as recommended for quail. None of these game birds should be released in dense woodland. Brushy ravines, overgrown pastures, or other waste land about farms are much better. Recommendations as to specific kinds of fruit-bearing shrubs attractive to birds and adapted to various parts of the United States are contained in Farmers' Bulletins of the Department of Agriculture, which can be had free upon application.

LIBERATING GAME BIRDS IN COVERTS

Game birds should not be released in coverts until everything possible has been done to improve food conditions and to free the place from the more destructive natural enemies. The great object in liberating game birds is to do it in such way that they will tend to become localized. If the time chosen is near evening the birds will not have time to wander far before roosting. Put down the shipping container near natural or felled brush cover, scatter suitable food about it, open only enough for the birds to creep out gradually, and promptly leave the scene. When returning to the spot for the basket or coop or for feeding, which should be kept up regularly until the birds are established, approach cautiously, and keep dogs and other animals away from the spot as much as possible.

The foregoing directions apply to liberation of the usual run of purchased or allotted birds, whether immature or adult. Best results are had from stocking with adults in the spring, but there are improved methods of liberating young birds that are much better than simply freeing them and trusting to luck. Some dealers ship broods of young game birds each with a foster parent, and these families are cared for in the covert as they would be in a rearing field. This method protects the young against starvation, and to a degree against enemies. Gradually the young will desert the hen and shift for themselves, and it has been observed that they are also tolled away and adopted by wild adults of their own species. It has also been found practicable with quail and Hungarian partridges to liberate broods of young in the care of surplus or wild-caught cocks of their own kind, to which the chicks have been accustomed at an early age. Wild cocks are caught in a trap similar to that illustrated in Figure 29, with the addition of a central compartment in which a hen is confined as an attraction. About a dozen chicks are sufficient for one cock.

The introduction cage with prospective foster parent in it can be placed near the coop containing hen and young birds, the latter being allowed to drift over to the adult of their own species, which is usually eager to adopt them, or chicks can be placed directly in a small darkened coop with the surplus cock, events being watched long enough to determine whether the young will be hovered; in the rare event that they are not, they will have to be returned to the hen or brooder for thorough warming before being tried again with another cock. The birds are fed as usual and are released with great care when from 4 to 7 days old. Broods liberated in the care of a wild cock will need neither shelter nor feeding, but in the case of pen-

raised cocks, it will probably be better to supply both so long as they continue to be used.

PRIMARY STOCK

The United States Department of Agriculture has no game birds or their eggs at its disposal, and notwithstanding press notices to the contrary never has distributed any of them. Some of the State game departments from time to time distribute certain game birds or their eggs, but the regular sources of supply are game farms and commercial dealers. Addresses of these can be obtained from the Bureau of Biological Survey, United States Department of Agriculture, Washington, D. C.

It is more economical, as well as desirable in other respects, to start with adult birds purchased late in the fall, for these will then be well settled in their new home before the breeding season, and the owner will have learned something about handling them before the busy and critical laying and hatching season arrives. Releasing the birds in pens should be done in the same manner as described for loosing in coverts (p. 18). In the case of penned stock, the flight feathers of one wing should always be clipped before the birds are released.

To obtain initial stock from the wild, it is necessary in most cases to have authority for capturing the birds from State game departments. (See paragraph on Licenses, p. 1.) Beginning with wild stock involves delays while the birds are becoming accustomed to restraint, which can be avoided by using propagated stock.

WING CLIPPING, PINIONING, AND BRAILING

The clipping of the primary feathers of one wing is sufficient to keep birds under the degree of control necessary on game farms and is the usual method. Many establishments, including some of the largest, never braid or pinion a bird. Pinioning especially is infrequently applied to upland game birds except fancy pheasants or specimen birds that are never to be released. As the extensively propagated species are kept for breeding only two or three years and then released, none of them are ever pinioned.

WING CLIPPING

Wing clipping is simply the shearing off of the principal flight feathers, or primaries, well away from the flesh of the wing, and it is necessary to repeat the process on adult birds at least annually after the regular molt in midsummer. Young birds must be wing clipped about every two weeks from the time they begin to fly until the adult plumage is attained. When for any reason birds capable of flight are desired, it is only necessary to pull out the stumps of the clipped feathers; new ones will come in at once and be fully grown in three to four weeks.

PINIONING

Pinioning means cutting off the last section (the fingers) of the wing to which the long flight feathers are attached.

To pinion an adult bird, raise the thumb of the wing (at base of last joint) and tie a cord tightly around the last joint well up under the thumb. (Fig. 14.) Have ready some tannic acid in powdered form. With a pair of strong, sharp scissors clip off the joint close below the cord, removing all or nearly all of the long flight feathers or primary quills. At once take a pinch of tannic acid and press it firmly into the wound to check bleeding. Glycerite of tannic acid (liquid tannic acid, 1 part; glycerine, 4 parts) also is used for the purpose. This seals the wound and gives good results. The cord should be removed a few days later when the wound is healing. Pinioning should never be done shortly before the breeding season. If full-winged birds must be rendered flightless at this time,

merely clip the primaries of one wing. Pinioning chicks is very simple. Operate when the birds are 4 to 7 days old, if in good condition, snipping off the last joint of the wing and dipping the stump into tannic acid. Bear in mind that a pinioned bird never can fly; so if flight is likely to be desired at any time, it is better to continue the clipping of flight feathers.

Only one wing should be pinioned or clipped.

BRAILING

Brailing is tying the wing of a bird so as to prevent flight.

It is for temporary use only, on birds being reared for liberation full winged, and in special cases when deemed advisable. There are various methods of brailing, two of which are here illustrated and described. Soft cord or preferably loosely woven tape is used. In method No. 1 (fig. 15) two pieces of equal lengths are taken and two knots tied so as to form a central loop with loose ends. This loop must be of a size proportionate to the wing of the bird being brailed; that is, it should slip easily over the elbow of the wing and fit snugly enough to hold it in the closed position. The loose ends underneath the wing are brought up over the top and tied in a square knot to the other set. In method No. 2 (fig. 16) a loop with one end of moderate length, the other much longer, is tied snugly, but not tightly, around the upper joint of the wing. The loose ends are tied in another knot, which should fall on about the middle of the upper sur-

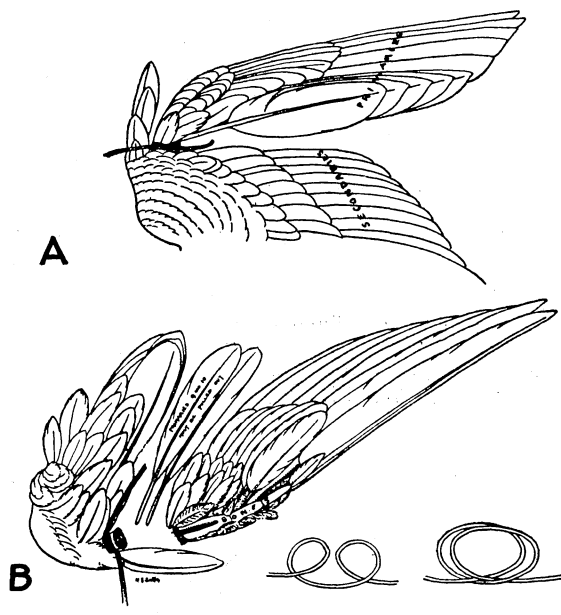


FIGURE 14.—Method of pinioning. A, Upper side of wing showing flight feathers separated from secondaries, and tied just within point of amputation; B, Underside showing place of amputation and form of knot used

face of the wing; the long end is then passed between the bases of the second and third primaries or flight feathers, across the under surface of the wing, put through the loop on the underside of the upper joint, brought back over the side of the wing to the top, and tied to the short end with a square knot.

When properly brailed the wildest bird can be allowed its liberty in an uncovered inclosure, and not being able to expand the wing it is incapable of flight. Brails must

not be left in place for extended periods, as stiff wings may result. This can be obviated by allowing the bird free use of the wings alternately for short periods.

Only one wing should be brailed.

RING-NECKED PHEASANTS

ORIGIN AND DISTRIBUTION

More pheasants than any other kind of game bird are raised by man, and probably nine-tenths or more of the total number of pheasants reared in this country are ringnecks. Earlier importations and rearing operations in the Eastern States centered about the English ringneck, a hybrid developed

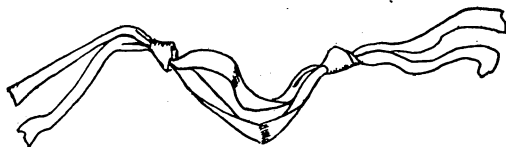
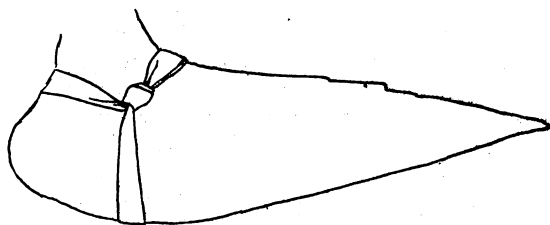


FIGURE 15.—Brailling; method No. 1

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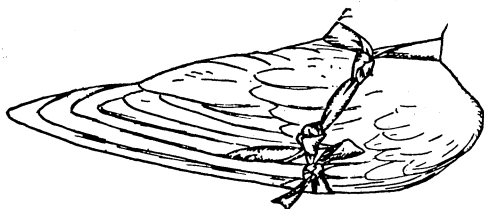
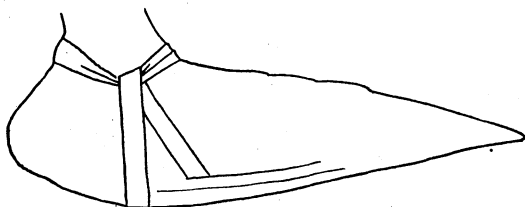


FIGURE 16.—Brailling; method No. 2

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in England between the common or black-necked pheasant and the Chinese pheasant. It is said that the Japanese pheasant also was freely crossed with the English hybrid. There are some pure black-necks in the country, and this race no doubt has been released in stocking operations. Some Mongolian pheasants, another ring-necked race, also have been used. In the Northwestern States, where pheasant-stocking operations have been successful, the Chinese ring-neck has been used almost exclusively; this variety has been distributed in large numbers also by the New York State game farms. An individual pheasant from coverts in the United States is likely, therefore, to be of hybrid breeding but is fairly certain also to have a preponderance of Chinese blood. All the birds mentioned in this paragraph are subspecific varieties, or geographic races, of a single wide-ranging species.

The hybrid ringneck has a variety of qualifications that fit it for propagating and restocking operations. It is polygamous and prolific and, while sufficiently controllable to be a success on game farms, retains its wariness and wildness so as to be well able to take care of itself when released. It is considered a hardier and gamier bird and has not lost maternal instincts to the same extent as has the English ringneck—an important point in relation to the increase of planted birds. Cold weather does not seem to hurt the ringneck; in fact, the bird has thrived best in the northernmost States. Numerous other pheasants have been hand reared and even used for stocking purposes, but for various reasons, as lack of hardiness, inadaptability to large-scale rearing methods, wildness, or sterility in captivity, none has proved worthy of comparison for general purposes with the ringneck. For an account of these pheasants, see the section on aviary or fancy pheasants, pages 46-48.

REARING EQUIPMENT

As previously mentioned, the use of ground free from the germs of disease and the renovation of fouled ground before reuse are controlling factors in systems of pheasant rearing. Though differing in details, all systems are adapted to meet these hygienic requirements. No one uses really permanent pens for pheasant rearing, for sooner or later new or thoroughly renovated ground must be had. So instead of speaking of temporary and permanent pens as distinctive of two types of rearing equipment and two schools of rearing methods, it is more accurate to refer to the small-pen and the large-pen systems.

SMALL-PEN SYSTEM

The keynote of the small-pen method of rearing pheasants is mobility. Not only are pens movable but they actually are moved at regular intervals to plots of fresh, uncontaminated sod.

BREEDING PEN

Within limits the size of the breeding pen can be regulated by the dimensions of available material. A common size is 12 by 16 feet on the ground and 7 feet high. (Fig. 17.) At the bottom of each wall are two boards, each a foot wide. These solid lower sides of the

cages are important in preventing annoyance to the birds by dogs or other animals running about, and except for expense and weight could well be higher. At a slight additional expense the owner of only a few of these pens can improve them by making a higher screen of burlap or sheet roofing.

The lower board on the long sides projects a foot at each end and is rounded off like a sled runner, and in it is a hole for inserting a lifting or pulling device. The lower board on each of the short sides is hinged to swing outward. When these are lifted the cage can be slid over the ground without damage; the swinging boards also permit the transfer of the birds to an adjacent cage with little disturbance.

A few hints on moving methods may be of value. Horses can be attached to the runnerlike sides, but this method is more apt to result in damage to the pen than is hand moving. For the latter purpose large, strong, iron hooks with comfortable crosswise handles greatly facilitate a combined lifting and dragging movement by men

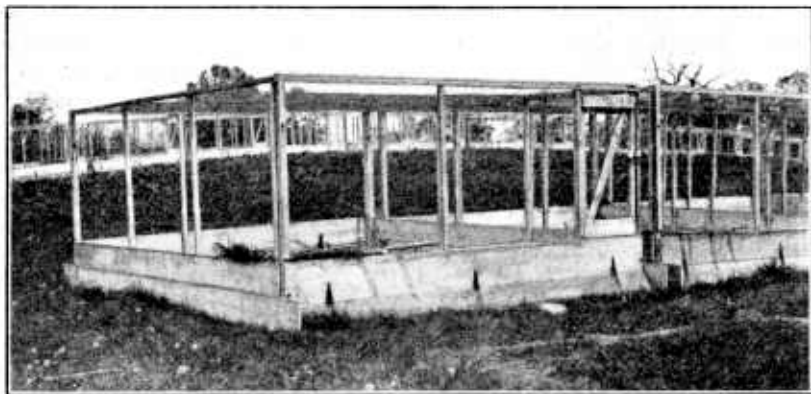


FIGURE 17.—Pheasant breeding pen

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By dragging them slowly the pens can be moved short distances with the birds in them. When they are to be moved farther the birds should be placed in a small coop, and it saves wear and tear on the breeding pens to carry them on the platform body of a low wagon or truck.

Some foresight must be used when placing the pens to allow for regular moving to fresh ground. Two systems each bringing the pen on four different plots of grass in three moves are illustrated in Figure 18. With this number of moves the pen stays in one place from 10 days to two weeks. For weekly moving, nearly twice as many units of land would have to be provided, and this can be more easily done by the solid row arrangement and longitudinal moving system shown in Figure 18, B.

Details of construction of a breeding pen are shown in Figure 17. The uprights are of material 2 inches square, and the corners are reinforced by $\frac{3}{8}$ -inch slats nailed over the netting. Two bolts are placed through the framework at each corner and a short brace across each corner at the top of the boarding. The door is large

enough for a man to enter. The netting throughout is ordinary 2-inch-mesh chicken wire. Along the side of the cage the uprights are clear of the ground, as shown in Figure 19, and those on the front and back do not extend below the upper board, arrangements that make it easier to slide the pen over the ground.

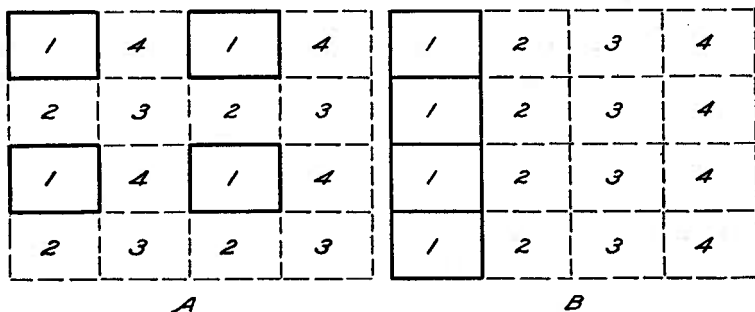


FIGURE 18.—Systems of moving pheasant pens

Some breeders provide a shelter by adding a board projecting inward from the lower part of the wall; this serves to keep a spot of ground dry where the birds can have a dust bath. Brush shelters under which the birds can hide and where the hens can resort for laying are essential; if they are attached to the pen as shown in the illustration they will cause no trouble in moving.

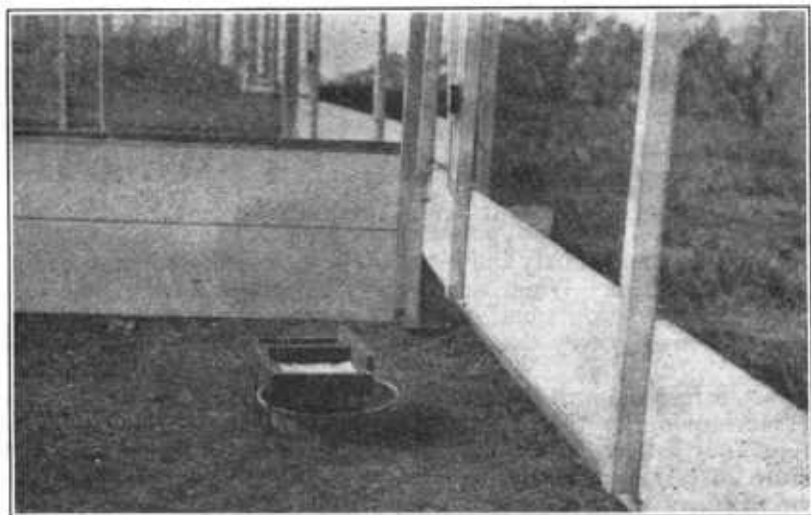


FIGURE 19.—Neat combination of food, grit, and water containers

Receptacles for food, grit, and water should be standardized and durable; the combination shown in Figure 19, in which the food and grit box shades the water pan or crock, is a good one. It should be set near the door of the cage so that it can be emptied, cleaned, and refilled with the least disturbance to the birds. In hot weather,

water must be replenished more often than food, so it is poured from a spouted can from outside the pen. One dash of water cleans and empties the pan, and a less violent pouring refills it. Breeding pens as well as all other inclosures for game birds should be so placed or constructed as to give the birds plenty of both sun and shade.

The function of the breeding pens is to house, protect, and keep the birds in such condition that there will be the maximum production of eggs. When the eggs begin to come in large numbers, other equipment is immediately needed. Methods of caring for the eggs until they are put under the hens are discussed on pages 35-36.

HATCHING COOPS

For convenience and economy, hatching coops are so planned that they can be used not only for housing the hens while they are incubating but also later when they are moved to the rearing fields to brood the young birds. The hatching coop illustrated in Figure 20 is 2 feet square, 23 inches high in front, and 12 inches at the back. The slatted door (1 foot high) is so constructed as to close, or, if slid to one side, to expose all openings between the slats forming the front of the coop. The closed position is normal for the hatching and the open for the rearing period. The slats are spaced

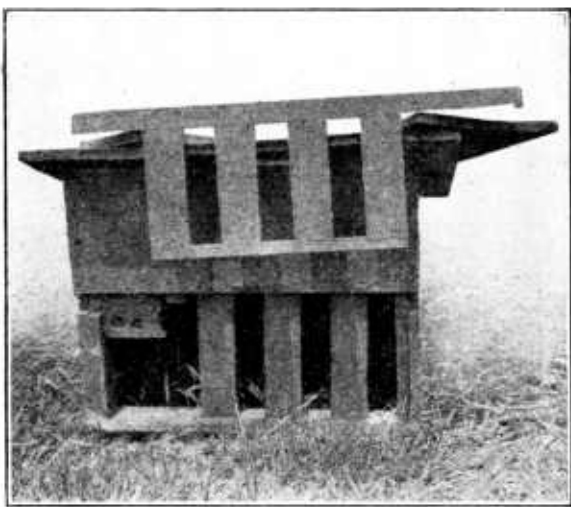


FIGURE 20.—Hatching and brooding coop

so that the young pheasants can run freely in and out of the coop, but so as to confine the hen. When it is desired to release her the sliding door shown at the left of the picture is raised.

The roof of the coop is 30 inches wide and 31 inches long and is provided with cleats on the lower side about 4 inches from each end that fit inside the walls of the coop and hold it in place. It should be made nearly or quite rain proof, with a covering of tarred paper or similar roofing if necessary. There is no floor. The coop is made of $\frac{7}{8}$ -inch material and may look clumsy and heavy, but there is good reason for this construction. Storms do not easily unroof or overturn the coops, and they stand wear and tear better. The roof should be weighted if necessary to prevent strong winds from blowing it off. The advantages of being rain and wind proof are obtained also by pyramidal construction of coops; or sometimes fibro-cement slabs are used for tops.

In the view showing the interior of the hatching coop (fig. 21) is the nest holder, a frame 5 or 6 inches high and 16 inches square. One of these frames is used to hold the nest in shape, and a second is placed on top of the other at hatching time to prevent the tiny young from scrambling away from the warmth and shelter of the hen, which are so necessary to them at first. The hole in the upper front of the coop shown in Figure 21 is for administering sprays.

EXERCISING RUNS

For convenience and economy of time the hatching coops are arranged in rows with space at the sides about equal to their own width, and sufficient in the other direction to allow for a path and to accommodate the exercising runs. (Fig. 22.) These runs are simple



FIGURE 21.—Interior of hatching coop

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frames, 36 inches long, 27 inches wide, and 23 inches high, covered with chicken wire on top and with 1-inch-mesh netting on two sides and one end. The top is removable, and the drinking cup is attached to the frame. These runs fit the front of the hatching coops and provide a place where the hen can exercise, be fed and watered, or confined whenever it is desirable to exclude her from the hatching coop. Some pheasant farmers tether the hens to pegs in front of the hatching coops during their exercising period. This system involves more handling and does not give the hen so much freedom; its chief merit would appear to be economy in equipment.

COMBINATION COOP

A combination hatching coop and exercising run is illustrated in Figures 23 and 24. The body of this is 30 inches square and is pro-

vided with two cleats on each side, so placed that a partition slid in them will divide the interior into two approximately equal compartments. The corner posts are $1\frac{1}{2}$ inches square and the cleats of $\frac{7}{8}$ -inch and the walls of $\frac{1}{2}$ -inch material. The door on the side, 8

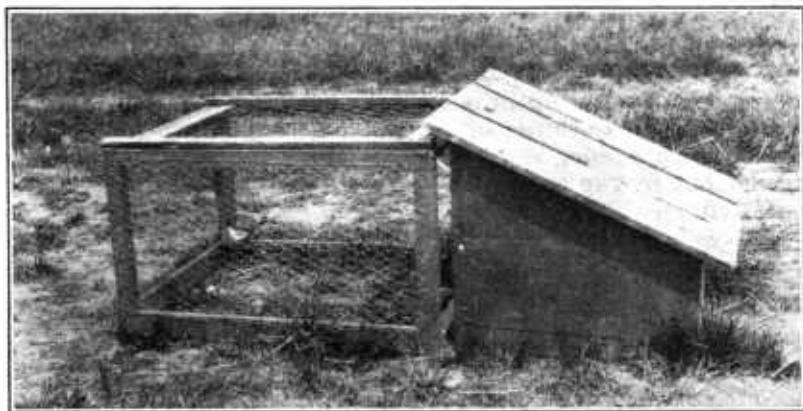


FIGURE 22.—Hatching coop with exercising run

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inches square, is hinged at the bottom and fastens with a button at the top.

The front of the combination coop is of 1-inch mesh, with a 3-inch slat across the bottom hinged to open upward, thus providing a place for the chicks to pass through. The button mounted on the block at the left side (fig. 24) holds the slat in position when fully opened. The coop is 18 inches high in front, 20 inches at the middle, and 15 inches at the rear.

The roof overhangs all around, and the back section is hinged and strengthened beneath by three cleats cut so as to hold it firmly in place when closed, the upper two cleats fitting inside the body of the coop, and the lower one outside. The front



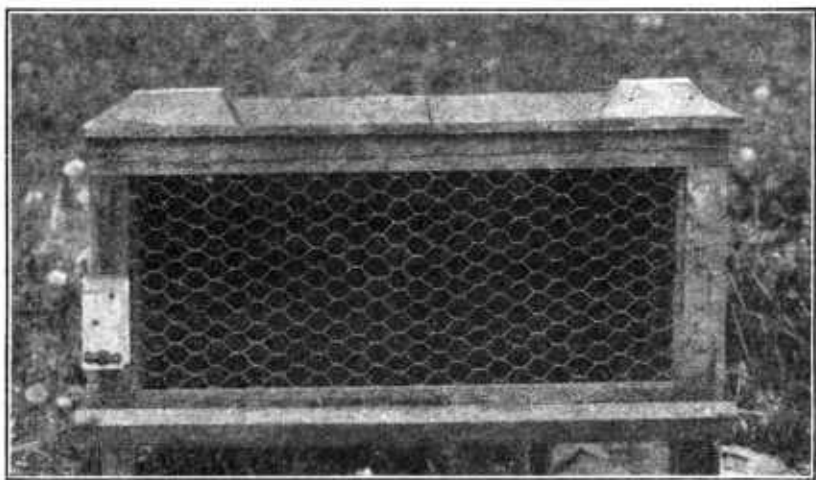
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FIGURE 23.—Combination hatching and brooding coop (side)

half of the roof is provided with two blocks upon which the rear half rests when open. This prevents undue strain on the hinges and makes a level surface on which the caretaker may place anything he may wish to set down for a moment.

A convenient rearing coop and inclosed range seen abroad is illustrated in Figure 25. The run, about 6 feet long, 2 feet wide, and 2

feet high in front and 18 inches at the back, is covered with $\frac{1}{2}$ -inch or $\frac{3}{4}$ -inch mesh, has no floor, and is hooked to the rearing coop proper of similar dimensions. The coop is one-third covered with a board and tar-paper roof, one-third with tar paper under the netting, and one-third with mesh only. There is a door at the end, and there are two on the low side with latches. The board-roofed section is partitioned off and has a sliding door in the inner end; this compartment has a floor of wire mesh (covered with soft hay), and the birds can be shut up in it at night perfectly safe from enemies. The remaining two-thirds of the rearing coop has no floor but is provided with a door shutting it off from the inclosed range. A hinged front in two sections gives facilities for varying shade and ventilation.



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FIGURE 24.—Combination hatching and brooding coop (front)

Breeding cages and hatching and rearing coops with their accessories are the principal items of material equipment for the pheasant breeder using the small-pen system. Besides these there are rearing fields and summer and winter ranges, which may be called environmental equipment.

REARING FIELD

So far as its vegetation is concerned, the preparation of a rearing field has been discussed under crop rotation (p. 2). Rearing fields should be on the higher or more rolling parts of the farm, well drained, and if possible with mellow, warm soil. The rank growth so desirable for the rearing field should consist partly but not entirely of clover, since a thick growth of clover alone holds too much moisture.

Shortly before the rearing field is needed for use single swaths should be cut in it from 50 to 100 feet apart. The hatching coops should be spaced 50 to 80 feet apart in the swaths, so as to allow for moving them 3 or 4 or more feet daily for 8 to 10 days.

(The illustration on the title-page of a rearing field in England shows stands of cover much narrower than the swaths, just the reverse of the usual practice in this country.)

The shorter grass in the swaths makes the work of the keepers in moving coops, watering, and feeding far easier and renders it less disagreeable on dewy mornings. The coops can be kept close to the uncut grass, so that the pheasants can easily reach it when taking cover. They will work all through it in their search for insects and small seeds. A little banking of soil around the coop is sometimes necessary to prevent water from draining into it. The coops should be placed on the rearing field a few days before needed, and in fine weather, so that the ground under them will be dry. When necessary, scratching by the hen can be discouraged by a covering of mesh over the bottom of the coop, or by setting the coop on a piece of burlap.



FIGURE 25.—Rearing coop and inclosed range

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LATE SUMMER RANGE

After the breeding season is over, it is desirable to have a fresh and ample range for birds that are to be held for the next season. These consist of about equal proportions of selected breeders of the current year and of two-thirds-grown young as they come from the rearing fields. Their late summer range should be land that has been prepared in much the same way as the rearing fields but from which more or less hay can be cut before the pheasants are put on it. It should be so managed, however, that when needed, several long strips across the field will have well-grown stands of millet, buckwheat, sunflowers, sorghum, or corn, which are valuable in providing both food and cover for the birds.

WINTER RANGE

Wooded rolling land with sheltered openings is ideal for winter range. (Fig. 26.) A few trees felled before the leaves have fallen or

piles of evergreen brush will serve as refuges from winged enemies. In addition to plentiful ground feeding, which will encourage the birds to exercise, weatherproof food hoppers should be freely provided and kept filled. Patches of rape make an excellent supplement to the winter food. Arrangements for watering should be adjusted to weather conditions. A stream or pond on the winter range solves the watering problem, but in the absence of either, receptacles will have to be provided and kept free from ice as much as practicable.

Birds can be carried over the winter in more restricted quarters but at the price of increased labor. Windrows of brush or straw supported by wire-netting fences can be used as windbreaks, and all food can be scattered in deep straw so as to keep the birds working for their living. (Fig. 27.) All the straw, however, should be cleaned up and renewed weekly if not oftener. Clover hay not only



FIGURE 26.—Open winter range for pheasants

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aids in compelling the birds to rustle for their food, but is eaten itself, thus providing roughage.

LARGE-PEN SYSTEM

Under the large-pen system, the management of pheasants is practically the same as under the small-pen system, except in the matter of equipment. It is well to bear in mind in this case not to build too solidly or expensively. Shallow setting of posts, light stapling of wire netting, and the like will help when the inevitable moving time arrives, and it may come suddenly and unexpectedly.

BREEDING PENS

Breeding pens may be 200 by 400 feet or larger and contain 250 or more birds. The sides should be of 1-inch mesh and the top of poultry wire, but it is well to have 2 feet or more at the bottom made

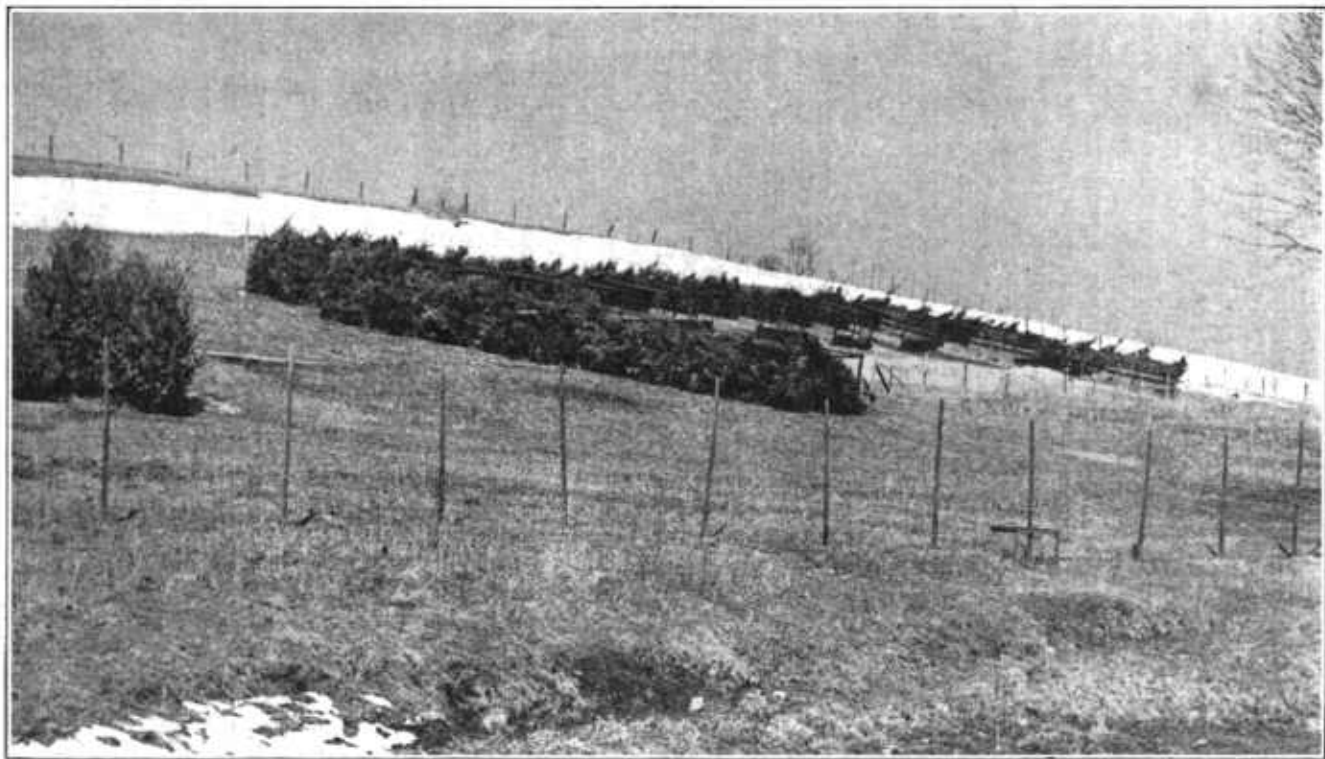


FIGURE 27.—Concentrated winter range for pheasants

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of boards (the lowest sunk in the ground) to provide shelter from winds, to exclude enemies, and to prevent dogs or other animals that prowl about the pen from annoying the birds. Where predators are especially troublesome the lowest course of the sidewalls can be of $\frac{1}{2}$ -inch-mesh wire netting extending 1 foot vertically into the ground and then outward 6 inches at right angles.

Shelter sheds (some of them built so that they can be used in trapping the birds) are usually provided along the side from which most severe weather can be expected, generally the north. The overhead netting must be staunchly supported to resist the weight of snow and sleet. In the case of uncovered yards, a section is partitioned off and roofed with netting to provide a place where the birds can be driven at night and be safe from enemies. The large breeding pens should have numerous piles of brush, under which the birds can take shelter, and ample food and water receptacles.

These large breeding pens are usually built in pairs, so that one can be spaded and limed or cultivated and planted for a season while the other is in use. Even so, the pens are moved to a new location after a few years.

Although much less expensive than small movable inclosures capable of housing the same number of birds, large breeding pens have certain objections urged against them. It is said that egg production does not average so high as in the smaller pens and that much more trouble is experienced because of fighting among the birds. Cocks are killed in fights during the early breeding season, and a less vigorous cock or a hen on which a wound is started during treading, if not removed, is soon worried and pecked to death by the others. Such occurrences are rare in the smaller breeding pens.

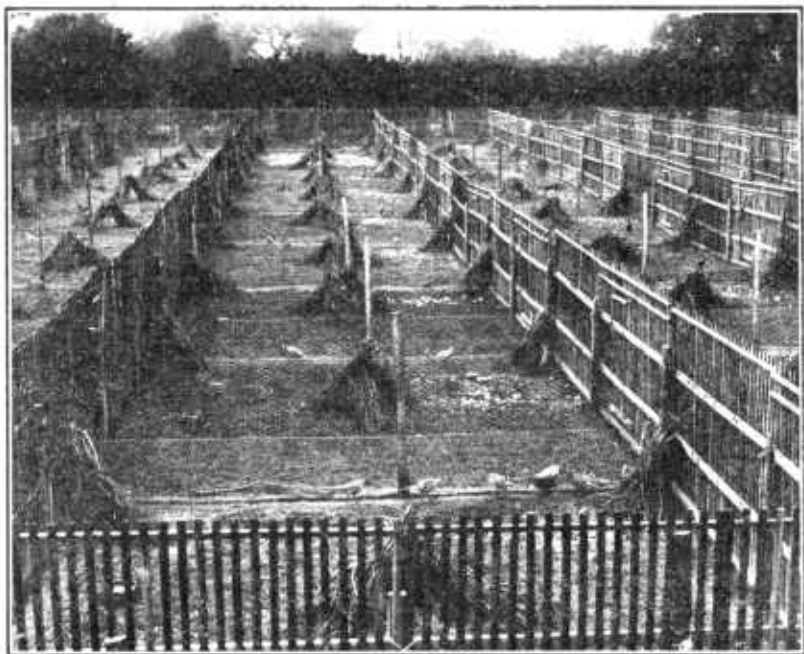
A system of pen building that retains some of the advantages of small pens while eliminating the labor involved in moving pens may be called the range system. As developed in the United States, the long sides of a range of pens are built much as suggested in the first paragraph on large breeding pens, and the interior is divided into small pens by easily removable mesh partitions. For ease of handling the partitions are made in sections of uniform size. One section in each partition must have a door, and it is well to align the doors throughout a range.

In England, ranges of pens are constructed by the use of hurdles, or sections of light picket fence. (Fig. 28.) The sections are 10 feet long and usually 6 feet 3 inches high. The slats are very close together on the lower 2 feet, or this portion is covered with tarred paper. The hurdles are supported by light posts put in holes punched with a crowbar and are lashed to the posts and to each other by short pieces of rope. The hurdles, half of which contain doors, are run in parallel rows, and across the rows run wire netting (lower 2 feet of 1-inch, remainder of 2-inch mesh) separating the pens, which are 20 feet square.

Details of equipment are much the same as in the other pen systems described. A special advantage of the range system is the ease with which a general inspection of the pens can be made. By looking through the mesh partitions practically everything in a range of pens is visible at a glance.

HATCHING BOXES AND HOUSES

Some of the hatching shelters are scarcely larger than the coops described under the small-pen system, but they differ in that they are built according to the battery system. In the simplest form nesting boxes are built in units of six compartments each, which have ventilating holes on three sides and a vertically sliding door in the other. Small feeding boxes in a series built to correspond are placed against the hatching boxes and the hens transferred to them for feeding and watering. The feeding boxes have a slatted front and a trough along it for the reception of food. Hatching coops with wire-mesh bottoms or none at all can be kept outdoors without other shelter, in which case the eggs usually do not need to be sprinkled



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FIGURE 28.—Ranges of pheasant pens of hurdle and wire-netting construction

with water. At one game farm it was found that a common feeding and exercising run for the hens was best, as the birds thus mingled were placed on different nests from day to day, and the effect of differences in their body heat thus being equalized, a more even hatch was obtained.

Aggregations of these hatching boxes are sometimes placed in a hatching shed that has removable sides, so that it may be kept cool. For the same reason the floor of the shed, the hatching coops, and other things in the shed are sprinkled daily in hot weather. The turf or peat used for the foundations of the nest in the boxes is saturated with water at the time of building the nest, and in unusually hot weather the eggs are sprinkled occasionally.

An item of equipment sometimes accompanying the batteries of hatching and feeding boxes is a box of six compartments, each with a sliding top, which, loosely filled with straw, is used in transferring the young from the hatching shed to the rearing field.

LATE SUMMER PEN

The size of the late summer pen may be whatever available funds will permit. The lower sides are of $\frac{3}{4}$ -inch-mesh wire netting and the upper sides and roof of 2-inch mesh. The lower edge of the fence is buried in the ground or attached to a tier of creosoted planks so buried. The inside height of the pen is sufficient to permit cultivating and planting operations. Rape is the favorite crop. Birds of the season to be used for stocking shooting coverts are kept in such a pen until needed, as well as birds that are to be wintered, until they have completed the molt and have been wing-clipped. Then they have an unclosed range, as described on page 29, as well as the run of a winter pen, as here described, which is left open and in which hand feeding is continued.

INCUBATORS

On most pheasant farms incubators are used only in emergencies, as when broody hens are not available in sufficient numbers when needed, when hens stop incubating and there are no substitutes, or sometimes to serve the purpose of brooders for short periods when very young chicks are chilled by drenching cold rains or other unseasonable manifestations of the weather.

On the Massachusetts State game farm, however, incubators are exclusively used for hatching pheasant eggs. The eggs are stored in a cellar and turned daily as under other systems of pheasant rearing. (See p. 35-36.) Six hundred eggs are incubated in a machine in one batch. The temperature is kept at $102\frac{1}{2}^{\circ}$ F. for the first week, then raised to 103° . The eggs are turned twice daily, tested on the twelfth and eighteenth days, and infertile eggs removed. Hatching begins at the end of the twenty-second day, and the young are kept in the incubators about one day after hatching. Then they are transferred in woolen-lined baskets to the brooders.

BROODERS

Coal-burning brooders similar to those used for poultry, with the addition of wire-cloth guards to keep the young pheasants away from hot parts, are employed at the Massachusetts farms. Brooder houses warmed by a series of pipes from a central heating furnace also are used, but the pipes are high enough from the floor to clear the heads of the young pheasants and are covered with burlap and a sheet of composition board to prevent the birds from being burned by perching upon them. The temperature in the brooder compartments is kept at about 100° F. for the first 10 days and then is gradually lowered to 90° .

That the birds may have exercise and get water whenever desired, the houses are lighted with electricity at night. Every compartment is washed, cleaned, and fumigated after occupancy by a batch of

young birds. Half the floors of the brooder rooms are covered with pine needles and the other half with screened sand.

The brooder houses open on wholly inclosed wire runs divided into four compartments, each sown to clover or buckwheat. For quick results the buckwheat is sprouted before sowing. The birds are admitted successively from one division of the run to another as the green growth is depleted. If the planted food does not become available as soon as needed, chopped lettuce is substituted. Brush is kept in the runs so that the birds will learn to take cover.

At night the young birds are driven back to the heated compartment, but as the time for distributing them approaches the houses are ventilated at night, thus hardening the birds in preparation for exposure outdoors. The birds are confined to the brooder house five or six days, and progress through the sections of accompanying runs at the rate of about one compartment every two weeks. They are distributed to coverts at 8 weeks of age.

INCUBATOR-BROODER SYSTEM

The percentage of eggs hatched by incubators (60 to 75) is less than that obtained under hens (80 to 90), and the losses of young in brooder houses are greater on the average than in rearing fields. On the other hand, equipment under the incubator-and-brooder system is less complicated, less expensive both initially and in the upkeep, and less troublesome to manage than are the hens, the hatching and rearing coops, and the rearing fields needed under the foster-mother system. There is some advantage, too, in keeping the young pheasants at all times away from hens from which they may become infected with disease or parasites.

It is uncertain at present to which system the balance of economy would incline in the long run. Economy is not the whole story, however, and breeders using the more natural methods of pheasant production believe that incubator and brooder raised birds can have neither the vigor and vitality of those grown outdoors in roomy rearing fields, nor the same degree of wildness, a vital factor in enabling them to escape natural enemies when distributed to coverts.

It is also urged, and this criticism applies to both rearing systems, that a true measure of the effectiveness of a game farm is not afforded by the number of 6 to 12 weeks old birds it releases, but by the number that actually reach maturity. In most stocking operations this number is entirely unknown, but on game farms where birds are held for stocking coverts at the shooting season or are reared for sale at maturity the net results of operations can be definitely ascertained.

CARE OF EGGS AND OF YOUNG AND ADULT BIRDS

EGGS

The eggs are gathered from the breeding cages every afternoon, with as little disturbance of the birds as possible. Baskets and buckets are the usual containers, and when all the eggs are collected they are taken direct to a storeroom, where tables with a thick layer of sand, oats, bran, or other poor conductor of heat await them. It has been stated that sawdust, shavings, and excelsior are unde-

sirable for this purpose, as they contain some oily matter, which may clog some of the pores of the eggs and interfere with respiration of the embryo. The eggs are placed on the tables in rows touching one another and turned twice daily, morning and evening. In order that the handler may know which eggs have been turned, the more pointed ends of all should be placed in the same direction the first day.

A dry, cool cellar is an ideal storage place for eggs, and when the temperature ranges from 40° to 50° F. they may be kept safely for 10 or 12 days before setting. When a cellar is not available the storage room used should be dry, and sunlight should be largely excluded.

Putting all eggs through this curing process and not setting them direct from the breeding cages, except in an emergency, contributes to uniform hatching. Time and energy will be saved, as a rule, by allowing eggs to accumulate until enough are on hand to set all the available hens. When there are more hens than are needed for one rearing field, set only enough to produce young birds up to the full capacity of that field. Eggs abnormal in any way should be rejected.

MAKING THE NESTS

After the hatching coops have been disinfected by being dipped in an antiseptic solution or by being thoroughly sprayed with a commercial louse killer, a square of sod should be taken up and some of the soil removed from the underside so as to permit formation of a slight depression. This sod should be thoroughly drenched with water and placed on that on which the coop is situated, giving enough elevation to assure that no damage will be done by heavy rainfall running in. Over the sod a smooth nest of straw or hay should be formed, dusted well with pyrethrum powder, and lined with grass clippings well worked in. Care should be taken to see that the nest is still well formed and smooth a day or two before hatching time.

INCUBATING

Preferences vary as to the type of hen to use for incubating pheasant eggs, but in general unfeathered legs, small size, and quiet disposition are desirable qualities. Hens obviously affected by scaly leg or any other fowl malady should not be used. Turkey hens formerly fancied by some breeders would seem most unsuitable; there is even a tendency to replace these birds with other poultry for the incubation of their own eggs. It is highly desirable that the pheasant farm have a flock of poultry^s amply large to supply the number of sitting hens needed, but sometimes the crowding production of pheasant eggs makes it necessary to search the country far and near to obtain the necessary broody hens.

When such hens are on hand, it is well to accustom one for a few days to each hatching coop that it is planned to use. Putting in a few hen eggs (hard-boiled ones are most satisfactory) may persuade

^s Information on all phases of poultry raising may be obtained by applying to the Bureau of Animal Industry, U. S. Department of Agriculture.

her to adopt the nest, but these should not be replaced with pheasant eggs until the hen seems well settled down to her task. When satisfied regarding this requisite, place the pheasant eggs in a single layer in the nest, 15 to 18 of them according to the size of the hen, dust the hen thoroughly with pyrethrum powder, and allow her to return to the nest. Inspection in a short time will reveal whether she has properly adopted the eggs; and if so, she may be left in peace. If the hen does not promise to be a good close sitter, the eggs should be given to another at once.

During the 23 to 27 days' incubation period (average, 24), the hen should be carefully removed from the eggs and liberated in the exercising run every morning, fed sparingly, and watered. Accustom the hen to being removed at a regular time. When approaching the coop make a low signal, clucking, whistling, or the like, but always the same. Lift the roof from the coop quietly, continuing the "conversation" with the hen; pat her back gently, proceeding backward slowly until the tail can be grasped firmly, and the hen lifted up on her legs and urged forward out of the nest. Care in this procedure saves broken eggs. If the day is warm she may remain off the eggs for an hour perhaps, but if the day is cold or wet, the period should be decidedly reduced. The nest should be inspected daily for the purpose of removing broken eggs, washing soiled ones (in tepid water without soap), or rearranging the nest and eggs if not in the smooth and orderly condition necessary to get best results from the body warmth of the hen. It may be necessary also to turn the eggs, as not all hens attend to this necessary detail. In dry weather the eggs should be sprinkled occasionally with tepid water.

Care should be taken to keep close watch for lice, for if these become numerous they will annoy the hen so that she may give up brooding. In such case the coop should be disinfected, the nest renovated and powdered, and a new hen put on the eggs as soon as practicable. Meanwhile the eggs may be temporarily cared for in an incubator or in a flannel-lined basket by the kitchen stove. As a matter of routine, the hen should be dusted with pyrethrum after about 10 days of incubation, and again a few days before hatching time. Pure pyrethrum powder is insisted upon because some of the louse-preventive compounds contain ingredients that have been found injurious to young pheasants.

HATCHING

As the day approaches when hatching may be expected, the first signs of pipping should be watched for. From this time until the young birds are all hatched and thoroughly dry, the hen usually will stay continuously on the nest and should not be disturbed. The second story of the nest frame described in the section on Hatching Coops (p. 26) should be placed about her; this will prevent the tiny young from scrambling away from the hen, and perhaps perishing from cold. Until the hen leaves the nest voluntarily after hatching she should not be fed or removed for any reason. She should have full charge of the young for 24 hours after hatching is completed. They do not need food at this time.

REARING

After this period, and on a sunny day if possible, the hen should be removed with her brood (the hen in a sack or under an arm, the young in a covered basket well filled with straw) to a coop in the rearing field. Place the chicks in one corner of the coop and set the hen near them, holding her with one hand so that she, in her eagerness to care for them, will not step on the little fellows. With the other hand gently urge the chicks under the flank feathers and wings of the hen, when she will settle down to brood. If inspection in half an hour shows all going well, it may be taken for granted that family relations are on the way to becoming established. The hen is confined to the coop, which for the first three days should be provided with a small run made of three boards 1 foot wide to keep the young from straying. The lower edges of these boards and the walls of the coop should fit the ground closely and have no holes through which the pheasant chicks can escape. By being confined for three days the young will receive the extra brooding they need in early life, have a chance to get well acquainted with their foster mother, and, what is especially important, will learn her calls. Some breeders maintain that this can be accomplished by shutting up the birds for a few hours with the hen in the rearing coop. If the hen insists on scratching, thereby endangering the young when in the coop, the trouble can be stopped by setting the coop on a piece of burlap. Some breeders use mesh-bottomed coops and runs to discourage scratching.

After the fourth day the board run should be removed and the position of the coop changed a few feet every day. After the eighth day the hen may be allowed to roam with her brood and the coop should be moved every three days. The tendency of the young pheasants is to cease roosting under cover and sooner or later even to fail to return to the hen. If possible, the brood should be penned in the coop at night when about 4 weeks old (otherwise they must be trapped), and the flight feathers of one wing clipped for the first time.

When about 7 weeks old the birds to be retained as breeding stock, which should always be from early hatchings, are again trapped, clipped, and released into a fresh rearing field. Birds that escape over the fence before wing clipping will try to get back again by running along the outside of the fence. They may be caught in movable traps (fig. 2) or by the use of wings or netting flaring out from the fence and tapering down to a pocket in which they will crouch and can be picked up.

Those to be used for stocking purposes are not clipped, but are kept in covered breeding pens regularly moved about on fresh ground, or in other suitable inclosures. Some breeders use such a rearing pen, covered top, bottom, and sides with 1-inch mesh, to prevent as nearly as possible all losses from natural enemies. Another method of handling flight birds is to keep them clipped until a month before delivery. The stumps of old feathers are then pulled, and new ones will be grown in 25 to 30 days. Birds selected for planting must have the use of their wings to enable them to escape their enemies. Moving young birds away from the hens and coops to a rearing field where there is no shelter should be done in fine weather, not when there is likely to be a drenching rain soon after the change.

CARE OF BREEDING STOCK

The young birds that are being groomed as the next year's breeders, together with any old birds that are retained, are successively transferred to the late summer and to the winter ranges. It is necessary to clip the flight feathers of the growing birds repeatedly; some breeders begin as early as when the birds are 4 weeks old, others make the first clipping at 12 weeks. This latter period falls about September 1 in the Northern States, and the wings are again clipped about October 1 and November 15. The partly grown primaries, never pinfeathers, of one wing only are cut off. The birds are thus unbalanced and efforts to fly tumble them to the ground. With both wings clipped, balance is restored and a fair sort of flight is possible.

TRAPPING

At every wholesale movement of the birds trapping is required, and it is well to explain how this is done. A row of breeding pens is placed side by side across the field occupied by the birds. The hinged boards at the bottom of both ends are left open, and food is scattered for the birds in these cages. Have them in position a week before needed, reduce the quantity of food a day or so before trapping, then bait the traps liberally, carefully urge as many of the birds as possible inside, and let down the gates. Scattered birds not thus caught can be picked up in funnel traps set along the fences, or in general-purpose traps like that illustrated in Figures 2 to 4. A long-handled dip net with a ring and a bag of liberal size is used to catch the birds individually in the large traps. Such a net is handy on other occasions also for scooping up loose single birds. Do not flop it on top of a bird on the ground and thus risk injuring it, but pick the bird up with a sweeping movement that carries the net into the air, where the bag can be folded over the rim so as to prevent the escape of the captive.

MATING

In the spring (late in March as a rule), when the birds are finally caught up for placing in the breeding cages, from 5 to 7, usually 6, hens should be placed with a single cock in each pen. Cocks are selected for size, vigor, and good condition of plumage, and surplus cocks are penned separately and all but a few disposed of as soon as practicable. When the eggs are removed daily from the breeding cages, from 40 to 60 eggs^a a season can be expected from each hen. Two and three year old hens are the most productive, but without placing numbered bands on their legs or otherwise marking them, it is difficult to distinguish between these classes. Hence the easiest way to assure partial renovation of the stock is to keep for breeders birds of the year, and old birds of mixed ages, in equal proportion. Some breeders mark the birds by punching one, two, or three small holes through the webbing between bases of toes, and thus are able to select by age; one prominent game farmer uses only yearlings as breeders. The birds may be marked as chicks by simply snipping the small webs.

^a A maximum of 104 has been recorded.

Bigger and more vigorous birds that will produce more eggs can be reared on the properly conducted game farm that can be purchased from so-called wild stock. If the pheasant breeder has healthy and fairly satisfactory stock, he had better gradually improve it than take the chances on devitalized stock and on the diseases and parasites that are involved in every importation of birds on the farm. Do not be perturbed by fear of inbreeding. That inbreeding is necessarily harmful is a completely exploded theory. All leading breeds of domestic animals have been perfected by the closest sort of inbreeding. Select the very finest birds for breeders, give them and their progeny the best of care, and you need not worry about inbreeding or have occasion to import "new blood."

FEEDING

Feeding is so important a factor in pheasant rearing that it can almost be said that proper feeding insures success. Certainly improper feeding can utterly ruin ventures in which every other factor affecting the birds seems correct. Young birds get their growth quickly and must have a properly balanced diet adequate in vitamins if they are to become well developed. When the bony framework is making its most rapid growth, diet is of supreme importance, and if it is not right, development will be so checked that it will never re-attain the normal. Food on the game farm must not only have all the elements that the birds need to make growth and keep up their vitality, but it must always be clean—clean to the uttermost—must be mixed only as needed, fed in just the right quantity, remnants picked up, and in all ways safeguarded so that fermented or stale foods shall be things entirely unknown. The vessels in which foods are mixed should be thoroughly cleaned and scalded each time after using. Regularity in time of feeding also is important.

ANIMAL FOOD

Animal food is essential in the diet of young pheasants. This fact has been realized by gamekeepers everywhere, and their efforts to supply this vital element of the food have been diverse and often extremely laborious, expensive, or otherwise objectionable. Ants' eggs because of scarcity, meal worms because of unreliability of supply, and maggots on account of repulsive features connected with rearing them and their not entirely beneficial effects on the birds have been tried repeatedly and by most raisers given up. Home-made curd, sweet skim milk, buttermilk, clabber, cottage cheese (without salt), custard, fish meal, cooked liver, and meat preparations also have had and still have their vogue. The individual pheasant breeder, however, particularly if operating on a small scale, will do well to use commercial pheasant mannas, chick meals, and the like, the composition of which has been brought to a satisfactory state as a result of cooperation between manufacturers and breeders, and the manufacture of which is surrounded by all necessary sanitary precautions. The largest and most successful pheasant farmers depend to a great extent upon commercial foods, even if they do mix or recombine them to suit individual fancy.

The most important source of animal food for the young birds is the supply of insects that they can glean in the properly prepared rearing field, but this supply should always be supplemented by animal matter mixed with the vegetable food fed. The proportion of animal matter in the prepared food can be varied to suit conditions and can entirely replace the natural supply in the event this fails.

THE FIRST FEEDING

The first feeding of young pheasants should be in the run in which they are confined after being taken to the rearing field. It will therefore be shortly after they are 24 hours old. They are fed every three or four hours during daylight for the first week and are given no more than they will pick up clean in a few minutes. It is better to keep them a little hungry than to overfeed them. Place the food not in a dish but on a smooth board, cleaned after every meal, or scatter it on a new spot of ground every time; dried-up remnants of food will do no harm; soured ones are fatal. The first feeding is given as early as possible in the morning and the last as late as practicable. Some feed only custard (made in the proportion of two beaten eggs to one cup of milk and cooked in a double boiler until nearly dry, and with no seasoning whatever) or grated hard-boiled egg the first day or two; others begin with a mash prepared as follows:

Mix thoroughly cold hard-boiled eggs, chopped fine, with an equal quantity of oatmeal, twice-baked bread or cracker, or commercial game meal, that has been run through a coarsely set chopper that will break it up as finely as desired, but will not pulverize it. The mixed food can be moistened with scalded sweet milk, broth, or boiling water, but only to an extent that will leave it an easily crumbled mash. Never give pheasants sloppy food.

Two boiled eggs and breadstuff mixed as described will make sufficient mash to provide three meals for 15 or 20 chicks. Whether feeding a large or small number of birds, never mix up more mash than will be consumed the same day, and it is safer to provide only for the next meal. So long as a hen is with the young pheasants the food given her should be of a type they can not eat; whole corn seems best, and boiled grain can be supplied if the hen has any difficulty digesting it when fed dry.

LATER FEEDINGS

During the second week intermediate chick grain, rolled oats, or crushed wheat are added to the ration, but no sudden change should be made in the food at this or at any other period. Vary the mixture gradually. Three meals a day are given, of which breakfast may be of the mash advised for the first week; dinner, chick grain or crushed wheat slightly moistened with water; and supper, the first-week mash to which has been added about a third of dry chick grain, rolled oats, or crushed wheat.

When the young pheasants are 2 weeks old their meals may be reduced to two a day, morning and evening. Chick grain, rolled oats, or crushed wheat (wheat flakes), slightly moistened with water,

or boiled wheat or rice, and an occasional feed of the first-week mash may be used. The birds are fond of clabber and of curd or fresh cottage cheese (no salt to be added), and these and the egg mash may form a larger part of the diet when insects are scarce in the rearing field, the weather is unfavorable, or when for any other reason the young birds are not making satisfactory growth.

From the fourth week until maturity, almost any dry small grains can be given, as oats, wheat, buckwheat, and scratch feed, but it is advisable, as a rule, to hold down the quantity of corn. It may be fed a little more freely in winter. Cooking at least part of the food, and feeding some mash, are advisable so long as the birds are confined. Breeding birds must have a proportion of animal food (about 10 per cent) before and during the egg-producing season, and it will do no harm to feed on this basis the year round. The grain ration for an adult pheasant is about 1 ounce a day.

LARGE-SCALE FEEDING

The feeding program recommended in previous paragraphs is one practicable for the beginner or the small-scale operator. On large game farms more food manufacturing is carried on, and more elaborate food mixtures are used. On one farm meat and bones from city packing houses are cooked, ground, and dried, and enter more or less into the diet of birds of all ages. Beef scrap and bone meal, buttermilk mashes, and other commercial articles are used by some. On large game farms a great deal of food cooking is done, even the small-grain rations being scalded or cooked for the sake of softening and sterilizing them, and as a means of supplying moisture to the birds.

The following is an example of a mixed ration used for adult birds on a large game farm: Corn and oats in equal bulk ground together, 22 parts; middlings, 11 parts; bran, 11 parts; mealed alfalfa, 5 parts. Mix with this 1 per cent of bone meal and half of 1 per cent of beef scrap on alternate days. For a few weeks prior to the laying season the proportion of bone meal or beef scrap is increased to 10 per cent of the whole. The alfalfa meal is scalded overnight and the remainder of the mixture the day used; when cool mix in the alfalfa, and feed it only crumbly moist.¹⁰ If too wet, middlings or bran can be mixed until it becomes sufficiently dry.

Sprouted oats or buckwheat, mowings of these grains from field crops and grass clippings when fresh, clover, spinach, chickweeds, lettuce, or any available green foods are valuable additions to the diet, especially of the breeding birds. A shovelful of turf thrown in a breeding pen daily provides green food, and a much-relished opportunity for digging. In winter chopped mangels, beets, turnips, or potatoes may be used to supply fresh vegetable food, and alfalfa meal or clover tops, scalded in water or broth, are a substitute. Green food must be supplied to young birds also when they can not be kept on a well-vegetated rearing field. Some breeders have found it beneficial to keep suet available to the birds, hung so that they will have to jump for it.

¹⁰ "Crumbly moist" means of a consistency that liquid can not readily be squeezed from the mixture, and that a mass of it will easily crumble.

A few details that should be observed in the preparation of pheasant foods may be emphasized. The food materials, whatever they may be—grain, bread, crackers, eggs, or even bone meal—should be cut, not pulverized; in other words, there should be the minimum of dust about such preparations. Powdered food can not be picked up by the birds or thoroughly cleaned up by workmen, and thus tends toward insanitary conditions. Powdery ingredients and too much moisture make sloppy food, and pheasants should never be fed slops. Receptacles and implements used in preparing foods should always be scrupulously cleaned, so that no sour or stale taint will ever occur.

DRY FEEDING

At least one successful American breeder has adopted the plan of feeding dry mashes from the very beginning. Commercial chick manna is used at first and gradually changed to a scratch-feed and beef-scrap combination. These dry foods are made available to birds in food hoppers, which need refilling only about once a week. The hoppers are under practically weatherproof shelters, so that the food never gets wet. Plenty of drinking water is a necessary accompaniment of this feeding system, and it is supplied in capacious fountains of the type used by poultrymen. The great advantage of the dry-feeding system is economy of time; one man can attend to three or four times as many birds as under the wet-mash system. Another advantage is practical immunity of the birds from disorders that arise from soured food. Dry feeding can be combined with the method previously described by keeping a dry mash constantly available to birds after the first week.

WATER

As a rule, fresh, clean water should be available to pheasants of all ages. Some breeders do not give it to young that are fed entirely on moist mashes. Since water generally must be kept in small open receptacles in the cages, it should be renewed daily as a rule, and more often in hot weather. In the rearing field there should be a small receptacle for each coop available to both hen and chicks, and larger ones should be set in shady places elsewhere. Stoneware tends to keep water cool. All receptacles should be shallow and should be thoroughly scrubbed and scalded weekly. When fountains are used they also are completely emptied and refilled daily. In large pens and on the later summer and winter ranges it is sometimes possible to supply running water, certainly a great convenience and labor saver.

GRIT AND CHARCOAL

A mixture of sharp grit, broken oyster shell, and charcoal is kept available to the birds at all times. The pens and ranges for adults have receptacles for this, but in the rearing fields finer grades of the same substances are thrown down with the food to supply the chicks.

VICES

EGG EATING

Some pheasants, especially cocks, form the habit of eating eggs. This is encouraged by permitting broken eggs to remain in the pens instead of cleaning them up thoroughly as soon as found. Increasing the proportion of animal matter in the ration may cure the trouble. If not, it can be discouraged by putting in the pens china or iron eggs painted to resemble pheasant eggs, or partially emptied eggs can be well spiced with kerosene and red pepper and placed in the pen where the trouble is experienced. In extreme cases the offending bird can be penned away from the others until the eggs are gathered, the upper mandible pared at the tip until it becomes too sensitive to be used for breaking eggs, or if the bird is (as usual) a cock, a surplus male can be substituted.

FEATHER PLUCKING

The vice of feather plucking is believed to result usually from a deficiency of animal food. Increasing the proportion of beef scrap or other animal element in the food is the remedy indicated. The possibility of mineral deficiency in the diet should not be forgotten; this trouble can be corrected by adding bone meal to the food. Feather plucking seems more likely to break out where large numbers of the birds are penned together, or perhaps the effects become more rapidly apparent because of the more numerous aggressors upon birds that become the least denuded of feathers or weakened. Such individuals should be removed to isolation pens at once and fed stimulating foods until their plumage and general health are fully restored. The same action is required when birds in the breeding pens develop raw places that will be pecked at by all their companions and enlarged sooner or later to a fatal extent.

DISEASES AND PARASITES OF PHEASANTS

Sanitation, or the practice of methods to prevent disease, must ever be the watchword of the pheasant raiser. Besides the general precautions urged in previous pages (p. 3), it should be emphasized that in domestic poultry is found the source of most if not all pheasant diseases, and game breeders can not be too careful in keeping the two groups of birds and their ranges well separated.

Prevention is the more to be striven for, since treatment in so many cases is impracticable. Some bird diseases spread like fire and in a few days may nullify a whole season's preparations and exertions. The treatments of various troubles as worked out by practical pheasant raisers are given below, and further information on the various diseases, their prevention, and treatment may be had by consulting Farmers' Bulletin 1337.¹¹

It is a useful general precaution to give young birds some non-poisonous disinfectant, such as 8 drops of a saponified cresol solution when a week old, increased to 15 drops later, in 10 quarts of drinking

¹¹ GALLAGHER, B. A. DISEASES OF POULTRY. U. S. Dept. Agr. Farmers' Bul. 1337, 41 p., illus. 1923. (Revised, 1925.)

water. Give the solution three days and then alternate three days with permanganate of potash in the proportion of one-fourth teaspoon to 12 quarts of water, a proportion that may be doubled or trebled later. A tablespoon of sulphate of iron to each 100 gallons of water also is a good prophylactic.

Regardless of precautions and remedies there will be some deaths, and effort should be made to remove and burn all dead bodies as promptly as possible. The ground where coops from which birds suffering from parasites or diseases have been removed should be thoroughly limed, any litter burned, and the coops disinfected. Sprinkling the ground freely with kerosene and flaming it is another good disinfecting process. As a part of general sanitation also, it is well to remove ailing birds to quarantine, where any trouble they may have will not be communicated to other birds, and where they can be kept under observation and treated.

Sometimes pheasant chicks droop or dwindle, although not apparently suffering from any specific illness. Such a condition is best met by immediate transfer of the brood to a new site, and if necessary by increasing the proportion of animal food in the diet. An outbreak of disease in a rearing field is the signal for immediately abandoning the entire field, which should not be used again until it has been thoroughly renovated.

GAPES

Gapes is the most prevalent and troublesome affliction of young pheasant chicks. As a matter of routine the chicks should be confined to the hatching coop and thoroughly fumigated with a gape remedy every two weeks until they are 8 weeks old. A home remedy is fumigation with a few drops of carbolic acid dropped on a hot brick placed in the coop behind some barrier that will prevent the chicks coming in contact with it. Place a sheet of glass over the coop and watch the chicks carefully. When they show signs of suffocation give them air immediately. The effect of the treatment is to induce coughing, which usually results in the gape worms being expelled. There are commercial gape remedies available, and in using these directions given by the manufacturer should be strictly followed. The danger of prolonged treatment is asphyxiation, but good results have been observed when the birds treated were reeling and seemed about to succumb to the fumes. If gapes become prevalent after the birds are away from the hatching coops, they can be driven into any shed or building that can be closed rather tightly and there fumigated in a flock. As domestic turkeys are now believed to be the normal host of gapeworms, it is inadvisable to use for the rearing of other game birds ground that has been ranged over by turkeys, or to have any of them in close contact with the rearing establishment.

DIARRHEA

As a preventive of diarrhea keep the birds in deep vegetation, and once a week to each 12 quarts of drinking water add one-half to two-thirds of a teaspoon of permanganate of potash. Curds, clabber, and boiled rice also are good preventive agents. As a remedy give no water except that treated with permanganate, and if time can

be spared administer olive oil to the birds, half a teaspoonful at a time until it comes through clear. Then feed the birds bread and milk, custard, or other soft foods until they recover.

SCALY LEG

The introduction of scaly leg among the birds can be held in check by treating with kerosene the legs and feet of hens kept for brooders, but this should not be done just before or during the time they are incubating the eggs or brooding young pheasants. Every time the young pheasants are trapped for wing clipping or other reason, dip the feet and bare parts of the legs into kerosene or apply this liquid with a stiff brush. A 5-per-cent solution of carbolic acid is also similarly used to treat scaly leg.

ROUP

Dip into antiseptic solution the heads of birds affected with roup to cure the trouble, and of those unaffected to prevent its spread. Antiseptics suitable for such treatment are: Boric acid, 1 ounce, water, 1 quart; or permanganate of potash, 1 dram, water, 1 pint; or peroxide of hydrogen, 1 ounce, water, 3 ounces. Though it seems rather drastic, some breeders advise the use of kerosene as a dip for treating roup. Others report that putting kerosene in water and food has cured troubles similar to roup.

LICE AND MITES

Head or body lice worry sitting hens, sometimes to such an extent as to make them desert their nests. Lice retard the growth of young pheasants and may cause their death. The thorough disinfection of hatching and rearing coops before use and the application of a louse powder to the nest and hen before hatching time have been discussed in previous pages (p. 36-37). In case a few lice may have escaped these treatments it is well to turn up with a stroke of a hoe a little bare earth near each coop in the rearing field, where the young birds can dust themselves. A little lard applied to the heads of the infested chicks will destroy the mites. The application should be made on a warm, sunny morning, when it will dry quickly.

If the behavior of a sitting hen indicates an infestation of night or spider lice, examine the coop at night, when the mites are more active and can be seen crawling about. If any number are found, spray the hen and the eggs with a louse killer and remove to a new nest; then burn the old nest and remove the coop for thorough disinfection with a coal-tar dip or spray.

AVIARY, OR FANCY, PHEASANTS

In this country all pheasants, other than the ringneck and its close allies used for stocking coverts, are known as fancy or aviary pheasants. The kinds of pheasants that are regularly dealt in and can be obtained with reasonable certainty in the United States at almost any time are the ring-necked, black-necked, Chinese, Mongolian, golden, silver, Lady Amherst, and Reeves's pheasants, and the Manchurian eared pheasant. Others that can be had occasionally are the Swinhoe,

Impeyan, Japanese or versicolor, Elliot's, Soemmerring's, and Formosan pheasants, and the Nepal, black-backed, black-breasted, and lined Kaleege pheasants. Most kinds of pheasants will adopt a polygamous habit, and it is this quality that fits them so well for hand rearing and restocking purposes. Some few of the rarer species, however, seem to insist on strict pairing, examples, according to present information, being such species as the Kaleege, Tragopan, and Impeyan.

Although the species classed as aviary or fancy pheasants have the reputation of being wilder, more nervous birds, and poorer breeders than the ringneck and its allies, differences in methods of rearing them are necessitated not so much by these characteristics as by the fact that they are reared only in small numbers. If the market justified the attempt, probably several of these species could be handled by the same large-scale methods that are used for the ringneck. Under present conditions of limited market, however, these birds are reared by most breeders only as a side line to the ringnecks. For the sake of economy, therefore, they must be handled with the least additional trouble, and for convenience they are kept separate from the ringnecks and from each other. The different species of pheasants will fight among themselves more than will individuals of any one species; hence they must be separately penned. A common rearing field is impracticable, because the hen foster-mothers would persecute stray chicks of a kind obviously distinct from their own brood.

These factors have guided the development of fancy pheasant rearing along lines very different in some respects from those obtaining in the ringneck business. Where aviary pheasants are raised as a side line the breeding pens are usually larger and remain on the same ground the whole season, thus saving labor. This plan works better with these birds than it would with the ringneck, as the fancy pheasants are not so inclined to eliminate every stalk of grass from their pens and then dig up the roots as is the ringneck.

The fancy pheasants also are given more effective protection from the weather in the breeding cages, and on winter range are placed in the most sheltered portion. Usually, however, the birds are in cages or runs of only moderate size the year round. One of these is the breeding cage, while others correspond to the rearing field and to the late summer and winter ranges used for ringnecks.

Fancy pheasants, never intended for liberation, are pinioned by cutting off the last joint of one wing when the young are 3 or 4 days old. This removes the necessity for the periodical clipping of flight feathers, as pinioned birds will never grow primaries on that side and never will be able to fly. Directions for pinioning are given on page 20.

One specialist in rearing fancy pheasants, who has bred no fewer than 16 species, keeps the birds penned at all times. His breeding cages are much like those described under the movable-pen system (p. 22-25), but stand on the same plot of ground all the season. His hatching coops are placed in similar pens, 12 by 15 by 5 feet in dimensions, the walls and top of 1-inch mesh. The coops and pens are of knockdown construction, so that all parts can be handled by

one man and piled flat for transportation or storage. The birds are reared in the same pen where hatched, and this is not moved during the season. The system of spacing and moving illustrated in Figure 18, A, is used, with the difference that the pens are moved only once a year and thus are on the same field four seasons instead of one. This gives plenty of time to renovate by cultivation and crop rotation another area to serve as the next rearing field. Stock not sold is wintered in a breeding or similar type of pen. The feeding methods of this breeder are described as the dry-feeding system (p. 43).

BOBWHITE QUAIL ¹²

Though for many years the propagation of the bobwhite¹³ was regarded as difficult or impossible, the combined efforts of a number of game breeders have solved the difficulties one by one until the methods of handling quail are as well developed and as successful as those used for the ring-necked pheasant. The Virginia State game farm, where propagation of this bird has been brought to the highest degree of perfection, is well equipped, and is as methodically operated and efficient in production as any pheasant-rearing establishment. Several thousand bobwhites have been reared on this farm in each recent year and distributed to coverts in the State. Production on a still larger scale merely awaits the demand that will justify it. Other species of native quail no doubt can be bred successfully under the same system as the bobwhite, with such minor modifications as climate and locality require.

The equipment and system used in quail propagation are similar in a general way to those long tried in the pheasant industry. Differences are chiefly those necessitated by the smaller size of the birds and their nonpolygamous nature, and to a lesser degree by their greater wildness and special dietary requirements. Because instructions relative to pheasant rearing have a general application here, details will not be given except to make clear the important differences in equipment or methods.

BREEDING STOCK

Ordinarily birds trapped in the wild will be most available as foundation stock for the prospective quail breeder, but much better results are had from birds raised in captivity. Wild birds may be caught in a variety of types of quail traps, but the simple funnel trap (fig. 29) baited with scratch feed is efficient and inexpensive. Traps of this type should be visited twice daily, if possible, and if only once, that call should be late in the evening, so that there will be little chance of birds being in a trap overnight. Otherwise, some predatory enemy is likely to find the trap occupied, wreck it, and probably destroy all the birds. The flight feathers of one wing of captured birds should be clipped, and, dependent on the season, the birds can

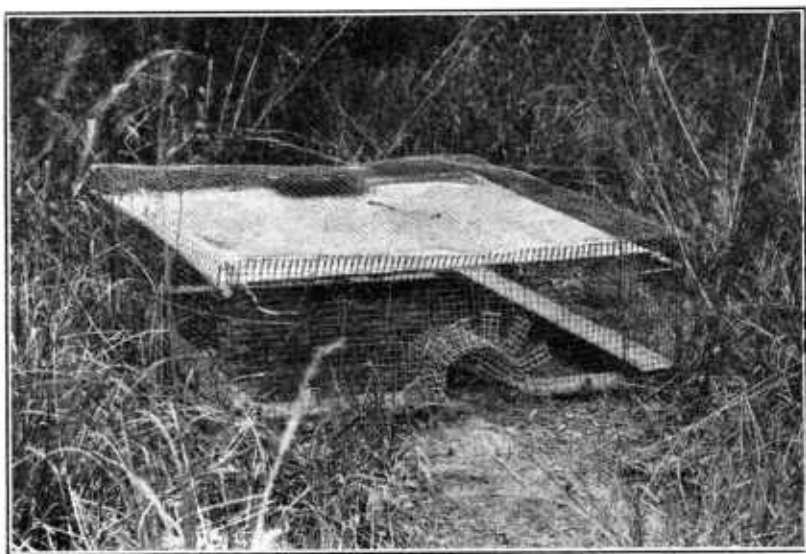
¹² In this connection the following publication will be helpful: STODDARD, H. L. REPORT ON COOPERATIVE QUAIL INVESTIGATION: 1925-26; WITH PRELIMINARY RECOMMENDATIONS FOR THE DEVELOPMENT OF QUAIL PRESERVES. 62 p., illus. Washington, D. C. 1926.

¹³ "Bobwhite" seems to be the most satisfactory distinctive term for the species called "partridge" in Southeastern and "quail" in Northeastern States. The term quail, although applied to different birds in Europe, is understood in this country to cover practically all the native gallinaceous game birds smaller than grouse, prairie chickens, and ptarmigans.

be placed in a large wintering pen (described later) or arbitrarily paired and domiciled in breeding pens. There are some indications that quail in captivity may tolerate a degree of polygamy.

BREEDING PENS

In the construction and use of breeding pens for quail there are several departures from the usage in pheasant rearing. The quail pens (fig. 30) are 5 feet wide, 10 feet long, and 4 feet high. The back half of each is boarded solid and has a waterproof roofing, which keeps the feed trays and dust bath always dry and protects the birds from hot sun or stormy weather. The front half is sided and roofed with hardware cloth, three meshes to the inch. Boards are placed around the bottom of the pen to the height of 16 inches, as



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FIGURE 29.—Quail trap. The small mesh ($\frac{1}{2}$ -inch) and cloth-top fender both minimize danger of captives injuring themselves. The fender, which should be taut, may be made of almost any strong cloth, but $\frac{1}{2}$ -inch mesh cord netting has the advantage of lower visibility

the birds are much better contented when they can not see out. A ditch ample to carry off any storm water is dug all around the pen and part or all of the dirt from it is banked against the bottom of the pen to give greater safety from natural enemies.

The pens should be placed in the sun on well-drained land that has a good natural growth of vegetation or has been seeded to clover, wheat, oats, or any other crop that will furnish green food. In the absence of growing vegetation chopped lettuce can be fed. Small brush piles under which the birds can hide or make the nest should be provided in the cage. Plenty of growing plants (broom sedge is good) in the pen, providing cover, is insurance against the birds damaging themselves by flying against the wire. The birds are fed and watered through a small door in the back of the pen.

The door in the front of the pen is large enough for a person to get through, but in order to keep the birds as quiet as possible the keeper avoids approaching the front except once each week, when the eggs are collected. When coming to the breeding pens for any reason it is well to give a low whistled signal, which the birds will soon learn. They will then crouch under cover and probably remain quiet while the keeper is renewing food and water or gathering eggs. Sometimes a box shelter is furnished to which they can retreat when alarmed. Without such precaution the birds may easily injure themselves, as their characteristic explosive burst of flight dashes them against the walls of the pen. Some breeders have taken the precaution to drape the entire ceiling of the breeding pen loosely with burlap to protect flying birds from injury.

Once a week with all care and quiet the eggs are gathered with a spoon firmly attached to a long slender stick, one or two of the freshest being left in the nest each time to keep the female striving to

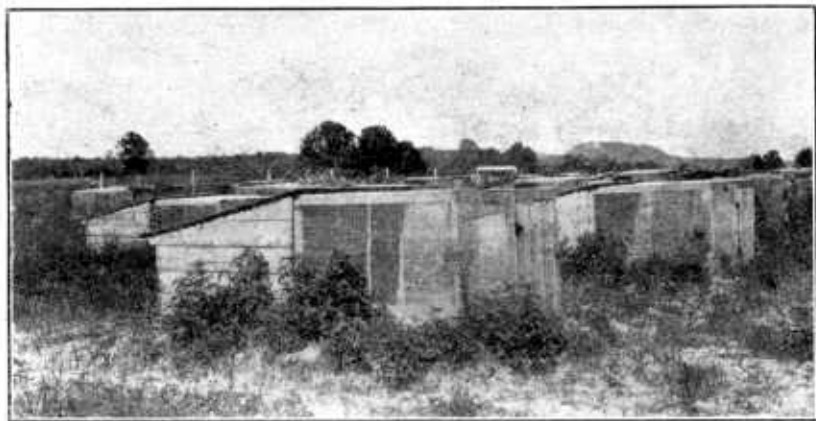


FIGURE 30.—Quail breeding pen

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complete a clutch. On the Virginia State farm numerous bobwhite hens have laid 90 or more eggs each in a season, and 128 were obtained from one. Birds reared in captivity lay better than wild-caught individuals, and egg production is well sustained; 4-year-olds have been known to produce 90 eggs in a season.

HATCHING THE EGGS

Quail eggs are stored and cared for in just the same way as those of pheasants (p. 35–36). Clean-legged bantam hens are used for incubating and are prepared for their task by dusting with insect powder before being placed on the eggs, and twice thereafter. The third application should be made not less than four days before the hatch is due. The incubation period is 22 to 24 days. The hatching boxes are placed on the ground under low, narrow shelters (fig. 31), and when thus arranged it is not necessary to sprinkle the eggs. In hatching houses the eggs are sprinkled with tepid water two or three times weekly.

Three inches of dirt is put in the bottom of the hatching box to prevent flooding, and over a depression in it a well-formed nest of fine hay is made. Fifteen to eighteen quail eggs, depending on the size of the bantam mother, are put in each nest. The hens are taken from the nests about 9 a. m. and put in feed boxes (fig. 31), where they are fed and watered, and the eggs allowed to cool for about 15 minutes. As soon as the eggs begin hatching, the nest boxes are darkened (fig. 31, back row) so as to keep the hens as quiet as possible. The hens are left on the nests until about 10 hours after all the eggs have hatched.

BROOD COOPS

When all the young quail are hatched and dried they are transferred with their foster mother to brood coops with small boarded runs attached. (Figs. 32 and 33.) These coops are 20 inches square,

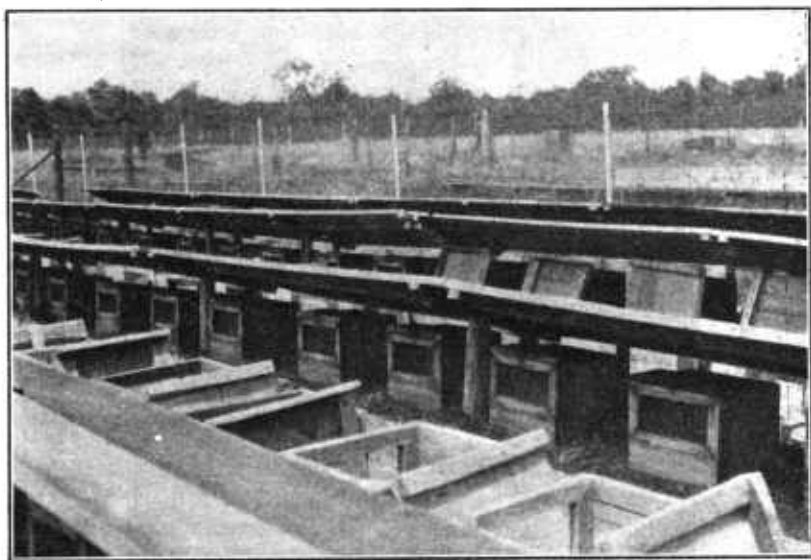


FIGURE 31.—Quail hatching boxes

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2 feet high in front, and 1 foot at back, with a 5-inch strip of $\frac{1}{4}$ -inch-mesh wire across the front and a number of small holes bored in the sides for ventilation. There is also a ceiling of fine-mesh wire in the coop 1 foot from the floor. This keeps the bantam from jumping up to the light coming through the ventilator, an action that may result in fatal trampling of the quail chicks.

The coops are floored also to reduce the amount of scratching done by the hen, another cause of death to the tiny quail. The floor is covered with fine hay or other litter before the birds are put in. The coops are hinged at the back and provided with a hook and eye in front so that they are easily opened and cleaned. A small hinged door at the bottom in front will pass the bantam, and a lower slatted entrance with suitable stopper is provided for the quail.

A board run 12 inches high, 20 inches wide, and 6 feet long is fastened flush to the front of the coop. The coop should be placed in

dense but short grass on new or renovated land and should be set well into the ground to prevent the escape of any of the young birds. Before the birds are placed in the coop, clean coarse sand is spread all the way across the run against the front of the coop; this makes a pathway, the upper edge of which is flush with the floor of the coop, and also provides grit for the birds. Baby-chick-size charcoal is scattered in each run. The quail chicks are shut up in the coop with the bantam at night. It has been found practicable also to use cock quail for foster parents. (See p. 18.) The cocks and broods are kept together three weeks and all shipped in company for liberation in coverts.

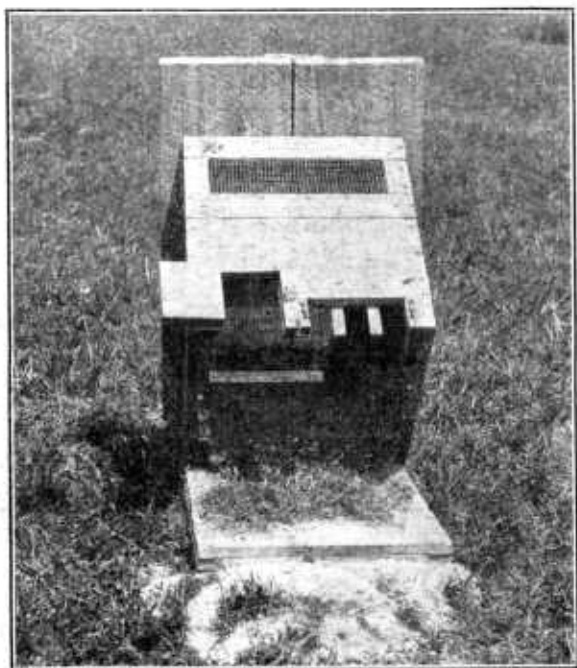


FIGURE 32.—Brood coop for quail

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INCUBATORS AND BROODERS

In experimental work at the Virginia State game farm, incubators have been used for quail eggs, and an average hatch of about 74 per cent obtained. A small type of commercial brooder also has been used successfully. The brooder is housed in the back of the closed compartment of the coop with a low cover of wood over it and with a partition placed against the edge of this cover to form a snug retreat for the very young birds. As the chicks grow the partition is moved farther away, permitting them to choose the degree of warmth they desire. Other things being equal, the use of brooders is an advantage in keeping the chicks away from bantams, thus greatly reducing the risk of infections. Twenty chicks are allotted to each brooder. When larger numbers and larger brooders were tried undesirable results became apparent. Incubator and brooder-

raised birds kept with cock quail foster parents have been distributed to coverts when 3 weeks old.

REARING PENS

When the birds to be kept with bantams are 5 days old, or those with brooders a few days older, they are moved to wire pens, a section of which 10 by 30 feet in extent is cut off by a partition fence from an adjoining run 30 by 50 feet in dimensions. The lower part of the netting is of $\frac{1}{2}$ or $\frac{1}{3}$ -inch-mesh hardware cloth extending several inches into the ground and reinforced above the surface with

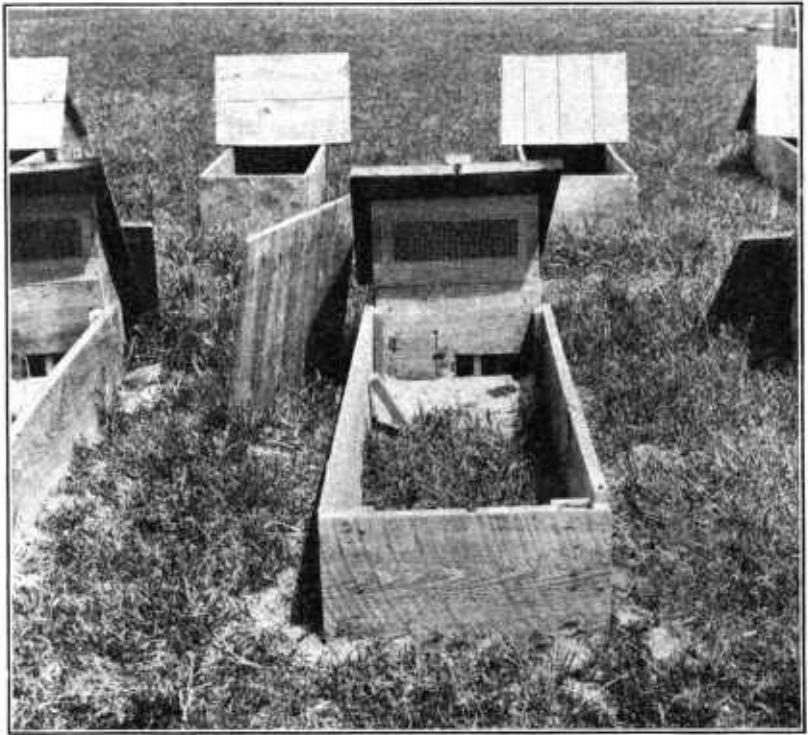


FIGURE 33.—Quail brood coop with boarded run

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8 inches or more of boarding. The small-scale breeder can save money by using coarser mesh and lining his pens at the bottom with tar paper. The grass is left long in the larger but cut short in the smaller pen in which the coop and bantam are placed. A useful adjunct for the rearing pen is sunflowers, which furnish shade and later seeds for the birds.

When 2 weeks old, the quail are given range of the larger pen, which they enter through holes at the bottom of the partition fence (fig. 34) small enough to exclude the bantam. Birds reared in these pens at the Virginia State game farm are distributed to coverts at 6 or 8 weeks of age. When the object is to hold birds to maturity, it probably would be better to adopt the rearing-field system as de-

scribed for pheasants, and see that the birds are kept well wing-clipped.

FEEDING

On the Virginia State game farm, under the first notably successful feeding system developed, only clabber from which the cream has been skimmed is fed for the first four days. It is put on a small dressed (and therefore easily cleaned) board, and this is placed close to the coop, so that bantam can have a share. The first feeding is given six or eight hours after the young quail have been transferred to the coop; the number of feedings is four a day. So long as clabber is fed no water is given. Ripe tomatoes torn open and stuck on



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FIGURE 34.—Rearing pen for quail. Note shade provided, holder for clabber dish (left), and opening through baseboard (seen to the right of the coop) to larger section of range

nails driven through small boards also are kept before the birds almost from the first.

In the rearing pen, clabber is constantly available to the young birds in small granite-ware dishes kept under waterproof shelters. A wooden disk, nearly as large in diameter as the inside of the dish, keeps the quail chicks from getting into the clabber but allows them access to a little of it at a time. Later, when the birds are bigger, the disk is supported above the clabber by four nails driven through it, still serving to keep the chicks out but allowing them to feed more freely. Clabber and millet seed constitute the food up to 2 weeks of age, when fine chick grain, rolled oats rubbed fine between the hands, and millet seed may be given in wooden trays under the waterproof shelter. Quail have been successfully reared on mashes either wet or dry as described previously in this bulletin under pheasant feeding (p. 40-43).

The bantam foster mothers are kept well fed on coarse food too large for the young quail to swallow.

Food for adult quail also is supplied in trays—hoppers no doubt would serve—kept sheltered from the weather. The trays are made with strips extending inward from the top to prevent the birds from scratching out the food. It prevents contamination of the food to set the tray on a frame covered with hardware cloth; under this is a sheet of tar paper. Scattered food falls through the mesh where the birds can not get it, and is held by the tar paper, from which it is easily removed and discarded. Food that has been found suitable for adults includes chick grain, pheasant meal, scratch feed, kafir corn, small cowpeas, wheat, buckwheat, millet, canary seed, rice, and rolled oats in varying mixtures, and commercial mashes for poultry. Sometimes a little beef scrap is added, especially before and during the laying season. Green food also is then needed. The birds must not be too fat at this time. Exercise will help to prevent fattening; hence in the winter pen, scatter food in the ground litter so the birds will have to hunt for it. Clabber is kept constantly available

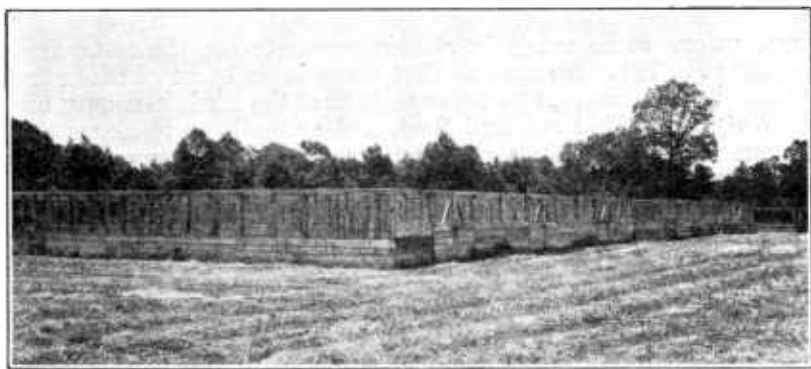


FIGURE 35.—Community pens for quail

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to the breeders. In winter, apples, turnips, beets, and cabbages are useful relishes, and in summer, wild berries of any sort and ripe tomatoes are used. Clean coarse sand, charcoal, baby-chick-size oyster shell, and fresh water are constantly available to the birds.

WING CLIPPING

When the young quail are 3 weeks old they begin flying. A few flight feathers on one wing are then clipped from birds that are to be released at 6 or 8 weeks of age. Those to be kept for breeders should have all the primaries of one wing clipped every two weeks until grown. Adults can be clipped once after molting. In performing this operation avoid cutting pinfeathers.

COMMUNITY PENS

Community pens (fig. 35), used for keeping breeders until put in the breeding pens, for wintering the birds, and for holding surplus birds at other seasons, are about 12 by 70 feet in dimensions (on the

Virginia State farm; elsewhere larger pens have been used). They are walled and covered with 1-inch-mesh wire netting, and the lower edge of the netting is attached to an 8-inch board placed in the ground to exclude enemies. As an additional protection, they are boarded around the bottom to a height of 2 or 3 feet. Burying the netting in the ground and lining it with tar paper above ground, or substituting galvanized sheet metal for the lower parts of the walls, are alternative types of construction. Both board and brush shelters are provided, and for winter part of the floor is covered with pine straw or other litter.

The pens should be high enough for men to work in them, or for horses if it is preferred to use these animals in renovating operations. A sufficient number of these pens should be available so that part may be vacated while the soil in them is broken up and while they are limed and cultivated and new cover crops are grown. To provide green food in the spring, oats, wheat, clover, or mixed grasses are sown in the fall; late summer cover would have to be provided by spring sowing.

STOCKING COVERTS

Precautions to be taken in stocking coverts are the same as for pheasants (p. 18). Manage so that there is no burst of flight from the shipping container, and arrange so that the birds can only creep out slowly, one at a time, find food, and see nothing to alarm them. The person releasing them should retreat quickly after opening the crate. To hold birds on a given area, have it planted in advance with seed producers attractive to quail. For details see page 17.

QUAIL DISEASES AND PARASITES

Much has been written but little is definitely known about a so-called "quail disease." There is no such specific malady, for the same or very similar symptoms have different injurious microorganisms associated with them, and it is usually impossible to say which is causative in occurrence and which secondary. Probably it is better to refer to quail disease as bowel trouble and to state that it is related in symptoms, and doubtless in cause, to the diarrheas and similar illnesses affecting poultry. It is not known to occur among wild quail, and is prevalent in proportion to the closeness, insanitation, and length of confinement.

Prevention is the main hope of avoiding losses through disease. Thorough sanitation at every step, and especially with birds being shipped, is necessary. The value of uncontaminated ground is as great in the case of quail as of pheasants, and the methods of assuring it are the same.

Mild outbreaks of bowel trouble may be treated by administering a third of a teaspoon of extract of catechu in each gallon of drinking water. In addition to the catechu about 15 grains of permanganate of potash may be added to guard against other infections. Moving the birds to fresh ground and giving them plenty of space are effective steps to take in stamping out disease.

Bantams, while otherwise valuable as foster mothers for quail, are reservoirs of diseases fatal to the young birds, and it pays to release

as many chicks as possible in the care of bobwhite cocks. (See p. 18.) Tapeworms sometimes cause serious losses of quail chicks, and it is said that some of these are acquired by the birds in eating house flies. Young have been reared in finely screened coops to prevent this trouble. Adult quail, particularly in the South, are universal carriers of coccidiosis, and in the adoption methods suggested here it is well to take all possible precautions to keep the young birds from pecking at the feces of the adults. Putting a raised floor of fine-wire mesh in the introduction cage will aid in this respect.

OTHER QUAIL

As a group the native American quail seem to be well adapted to rearing in inclosures. So far as known methods of handling other species can be adapted with little change from those found practicable in the case of the bobwhite.

HUNGARIAN PARTRIDGES

The Hungarian partridges now established in North America are almost exclusively the descendants of birds that have been imported and released directly into coverts. In European countries propagation of this species takes the form of various expedients to aid the wild birds, and pen raising is considered impracticable. The partridge has been reared in confinement, however, and it is probable that with persistent effort full success will be attained. With Hungarian partridges, as with most other game birds that have been propagated, the superiority of hand-reared over wild stock is very marked, and it is probable that when artificially propagated breeding stock is freely available the rearing of Hungarian partridges in inclosures will not be considered unusually difficult.

Hungarian partridges, like our native quail, are scarcely polygamous and must be penned in pairs. Because of great similarity in plumage of the sexes, and variations due to age, arbitrary pairing is impracticable. The birds are said to do best with mates of their own choosing, and to obtain natural pairs the following system has been developed:

The community pen in which the flock is kept is provided with small connecting pens, the outlets from which can be closed by a door released by a cord from a convenient blind, where an observer conceals himself as the mating season comes on. Pairs have a tendency to withdraw from the flock, and are likely sooner or later to wander into one of the small pens, and then the door can be dropped. Even then the birds should be watched, for should a third one come to the door seeking entrance to the small pen it is likely to be the mate of one of the penned birds. In such case the door must be lifted and another occasion awaited. When a true pair is isolated from the flock, they can be caught and placed in a breeding cage similar to those recommended for quail.

If all birds are provided with numbered leg bands and a record kept as to sex, the same pairs may be mated a second season, or other arbitrary pairing combinations tried. No fewer than 52 fertile eggs have been obtained in a season from a single pair on an

American game farm, a good augury for the future and an indication that pen rearing can be made more effective as a means of increasing the species than any of the systems of aiding the wild birds, although it will be more expensive and will be the method for the professional game breeder, rather than for farmers and sportsmen. The period of incubation is reported to be from 21 to 26 days.

Rearing equipment and methods may be much like those for quail. The Hungarian partridge, like the bobwhite, starts its flight with a tremendous burst of speed, and great care must be observed to prevent the birds from injuring themselves by dashing headlong against the walls of inclosures. Breeding stock should have the flight feathers clipped, but adults to be liberated must be full-winged, and young, although clipped, if kept in pens during early life, must be allowed to grow full-length primaries before release.

Hungarian-partridge chicks, according to present experience, seem very dependent upon a good supply of animal food, and a rearing field with abundant insect life should be available for bantam-mothered birds. Cock Hungarian partridges are devoted parents, however, and if a supply of surplus cocks is available it is well to release the young in their charge as early as practicable. Directions for assuring adoption of the young are given on page 18.

Feeding may follow, probably with equal success, either the plan recommended for pheasants or that for the bobwhite. One successful American breeder uses hard-boiled eggs and fine oatmeal for the first few days, after that adding partridge meal, and later millet, hemp, and canary seed. Adults prior to and during the breeding season are given millet, hemp, wheat, cut oats, and meat scrap. In winter buckwheat, millet, and wheat are fed.

Where game farming can be carried on in connection with a range stocked with Hungarian partridges, it is the usual practice to take the first clutch of eggs, particularly from nests that seem too exposed or otherwise liable to destruction, and set them under small hens or place them in incubators. The female partridge will then lay another set of eggs. Young hatched at about the same time as those of wild birds sometimes are released close to the nests and they are quickly adopted by the wild pair.

NATIVE GROUSE

If grouse trapped wild are used as foundation stock, the chief difficulty arises from their extreme shyness. They should be wing-clipped, so that they can not dash against the wire, kept in roomy inclosures with plenty of cover, and accustomed gradually to visits of the keeper by always feeding at the same place and moving cautiously at all times.

Grouse are too valuable to keep in uncovered pens and should be thoroughly protected against vermin. In winter a community pen may be feasible, but in the breeding season each pair of ruffed grouse must be given a separate inclosure. The males are pugnacious among themselves and severe with the hens in mating. Sometimes it is necessary to keep the cock away from the hen, except for the short periods actually necessary for fertilization.

It seems necessary to allow the hen to complete a clutch of eggs before they are taken, and then she will sometimes lay another.

Unless this happens regularly there would seem to be little advantage in taking the eggs away from the female at all, for grouse are good mothers. However, birds reared by hens will grow up tame, and if successfully held over will provide more manageable breeding stock. By this method eggs obtained from the nest of a wild bird can be used at the start. Twenty-four days is the period of incubation.

The system of rearing can be the same as for quail, but be sure the young birds have plenty of shade; strong sunlight will kill them in a short time. As ruffed grouse grow up, it seems almost necessary that they have more or less of the food they naturally get in woodlands. Their range should furnish browse and buds, and wild fruits and acorns can be supplied from time to time. Grouse of the open country, like prairie chickens, probably can be raised by the same methods as quail.

WILD TURKEYS

The greatest difficulty in connection with the propagation of wild turkeys is to get birds of the true wild stock. The turkey that is native to the Eastern United States, over most of which it originally occurred, has a plumage that gleams like burnished metal; the rump feathers are dark reddish apically and the tail is dark reddish in general and dark brown at the tip. In the domesticated turkey, which is descended chiefly from Mexican stock, the tips of these feathers are whitish and the plumage in general is less metallic. Tame turkeys, however, readily become wild, so that if pedigree is not an important consideration, almost any stock will do, for the birds can be so managed that the progeny will be wild enough for sporting purposes.

The breeding birds, either wing-clipped or pinioned, are kept in a roomy field of the old-pasture type with plenty of natural growth. It is well to have a separate range for young males, as otherwise they will be persecuted by older ones; one adult tom is sufficient for several hens.

The breeding pen is partitioned off from a liberal range of woodland, all under fence. One successful breeder uses a 9-foot fence, of which the lower 5 feet is ordinary farm-stock fence graduating from small mesh below to larger above and the upper 4 feet of coarse mesh. This is not vermin-proof, and when such a fence is used natural enemies must be dealt with otherwise than by exclusion. In the smaller field is a poultry house divided into compartments provided with roosting perches. The upper half of the front of the house is of wire netting, and the lower half of doors that can be closed at night and on stormy days. Usually the birds must be driven in, but feeding them there at times and keeping a dry mash available in hoppers will reduce this difficulty. Some breeders allow the birds to roost in trees. Brush heaps are scattered over the breeding field, and the hens lay under these.

The eggs are removed daily, one genuine or one dummy egg being left in each nest. They are set under hens in ground nests under the shed. The young are handled like pheasants in a rearing field and are shut in with the hen at night and also by day until the dew has dried off, or in wet weather. Some breeders use female domesticated turkeys for foster mothers. The young are allowed free range with

them at from 10 days to 2 weeks of age. This system obviates dangers of contracting poultry diseases. In some cases the wild-turkey hen is robbed of one clutch (about 18 eggs), then allowed to incubate what she lays later and to rear the brood. Under this system she should be full-winged.

Another plan is to give each female turkey a roomy individual pen, to which the male is admitted when the actions of the birds indicate the proper time, but from which he is excluded at all other times. The smaller pens should have plenty of brush and growing cover and old leaves or other litter on the ground, in which the nests can be formed. The period of incubation is 28 days.

The food for young turkeys may be much the same as that for pheasant chicks, though some breeders have found the use of clabber fully as beneficial in results as it is in the case of quail. Avoidance of overfeeding is very important.

Breeding birds are fed on a mash composed of bran, cut oats, wheat middlings, and corn meal in about equal parts. This is moistened with fresh milk, and after the female has begun to lay, a fresh hen egg, including the shell, is added to the mash for each bird to be fed. Beef scrap also is made available, so that the turkey hen can take what she needs. After the short period allowed for feeding, however, all remainders should be cleaned up.

Adult birds are fed like chickens, except that, in addition, patches of wheat, buckwheat, millet, corn, and the like are sown for them. To allow cultivation and growth of these grains the range of the breeding birds should be partitioned into two approximately equal parts, in either of which the birds can be confined as desired. The planting of grain patches also serves to hold the birds in coverts that are stocked.

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